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SUMMARY OF DISCUSSIONS AND CONCLUSIONS

OF THE

FOURTEENTH MEETING OF THE NAT SYSTEMS PLANNING GROUP

(Paris, 17 - 28 April 1978)

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1. Introduction

1.1 Convening and conduct of the Meeting

1.1.1 The 14th Meeting of the NAT/SPG was held in the European Office of ICAO from 17 to 28 April 1978. Further to the usual participation by the Members of the Group, IATA and IFALPA, the Group had also invited Denmark, Iceland, Norway and Portugal, as well as ACCA, IACA and IAOPA to attend this Meeting, because of the need to take into account their views on some of the subjects discussed. With the exception of ACCA, all invited States and International Organizations were present.

1.1.2 Prior to the convening of this Meeting, consultations had taken place between the Members of the Group in order to determine whether preparatory work, to be undertaken in collaboration between the USA on the one hand and Trinidad and Tobago and Venezuela on the other, regarding crossing and joining traffic in the NAT Region and originating in or bound for these two States, had progressed to the point where a participation by these two States in this Meeting, in accordance with Recommendation 6/15 of the CAR/SAM RAN Meeting 1976, could be justified from a cost-effectiveness point of view in the light of results likely to be obtained during this Meeting. As it was felt that this was not yet the case, the Group postponed an invitation to Trinidad and Tobago and Venezuela to attend this Meeting. However, it confirmed the principle of such an invitation at the next suitable opportunity, and the two States were informed accordingly through ICAO.

1.1.3 Shortly before the opening of the Meeting the Group was seized with a request by Spain to attend this Meeting because of that State's interest in the problems encountered with traffic crossing or joining the major traffic flows in the NAT Region. There being no time for full consultation of all Members of the Group, the Chairman decided to agree to this request and Spain was therefore represented at this Meeting. At the opening of the Meeting, the Group however wanted to stress once more its freedom in deciding who should be invited to attend NAT/SPG Meetings in an effort to maintain efficiency in the conduct of its work when compared with the size of attendance. (For previous experience in this field see paras. 1.2 and 1.3 on page ii of NAT/SPG Summary/13).

1.1.4 The Meeting was chaired by Mr. J. G. ten Velden, the Member from the Netherlands, and a list of participants in given on page viii. The Meeting of the Group was conducted throughout as an open Meeting.

1.1.5 For some of the Agenda Items, the Group created ad-hoc drafting groups of varying composition. The more important Groups were:

a) a drafting group on Item g) with Mr. R. M. Whitford of Ireland as Rapporteur; and

b) a drafting group on the mathematical aspects of Item 1 with Mr. P. Brooker of the United Kingdom as Rapporteur.

1.1.6 Mr. P. Berger served as Secretary of the Meeting, assisted by Messrs. E. Cerasi and C. Eigl. Messrs. W. Arcangeletti and F. E. Sperring also particpated part-time in the Meeting and acted as advisers on communication questions. All five are Members of the European Office of ICAO.

1.2 Request for full Membership in the NAT/SPG by Spain

1.2.1 Concurrent with the request for attendance at this Meeting mentioned in para. 1.1.3, Spain had also requested advice on the procedure to be followed in order to obtain the status of full Membership in the Group. After consultation of relevant documents concerning the constitution of the Group, the representative from Spain was advised that the Group had been constituted by the Governments of Canada, France, Ireland, the Kingdom of the Netherlands, the United Kingdom and the United States at the specific request of the Special North Atlantic Meeting 1965 (Recommendation 4/1 of that Meeting refers), and had been confirmed in its function and composition by Recommendation 3/2 of the Fifth NAT RAN Meeting in 1970. It therefore appeared that a change in the composition of the Group could only be obtained by an appropriate Recommendation of another NAT RAN Meeting with due endorsement by the Council of ICAO. In addition, the Group felt that the frequent participation in its Meetings by Denmark, Iceland and Portugal, amply demonstrated that there was no need to change its composition because it was able to obtain necessary advice and information through participation, on invitation, from other concerned parties as required by circumstances and subjects scheduled for consideration at its Meetings.

1.2.2 The Group would continue - as had already been done in the past - to invite Spain to particpate in its Meetings whenever it was likely that particular interests of that State were concerned or when it could be expected that information and/or advice from Spain could contribute to further the work of the Group. In this connection, it was already possible for the Group to extend an invitation to Spain to attend its 15th Meeting in view of discussions which would take place regarding the traffic flows between the Iberian Peninsula and America.

A G E N D A

Item 1: Development of measures to permit the application of 60NM lateral separation in the MNPS airspace of the NAT Region as of 5 October 1978 in the light of data on aircraft performance obtained since 29 December 1977.

Item 2: Review of the situation with regard to the provision of special routes; and temporary arrangements for aircraft unable to comply with MNPS.

Item 3: Review of work undertaken up to that Meeting on crossing and joining traffic in the NAT Region.

Item 4: Determination of the new format of the NAT Traffic Forecast prepared by the NAT/TFG.

Item 5: Conclusion of final arrangements for a large scale data collection in Summer 1978 on longitudinal separation in the NAT Region.

Item 6: Initial discussion of future trends in navigation and ATS in the NAT Region as they present themselves after the introduction of the MNPS and determination of future detailed work required on this subject.

Item 7: Review of the situation regarding the navigation and communication capability of IGA flights in the NAT Region.

Item 8: Review of the separation applied between SST aircraft while in supersonic flight.

Item 9: Review of the HF air-ground communication situation.

Item 10: Any other business:

a) status of proposal for amendment of the NAT SUPPs regarding the need to contact the ocean station vessels;

b) situation regarding uniform procedures for the establishment of temporary airspace reservations;

c) use of composite separation by Canada;

d) preparation of a consolidated VHF GP coverage chart for the NAT Region;

e) exchange of view on ATS data exchange requirements in the NAT Region and resultant demands on the aeronautical fixed service in the medium and long term;

f) automated exchange of ATS messages between OACs;

g) updating of the NAT Guidance Material;

h) arrangements for the next Meeting.

LIST OF CONCLUSIONS

LIST OF PARTICIPANTS
LISTES DES PARTICIPANTES
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Agenda Item 1: Development of measures to permit the application of 60NM lateral separation in the MNPS airspace of the NAT Region as of 5 October 1978 in the light of data on aircraft performance obtained since 29 December 1977.

1.1 Introduction

1.1.1 The Group noted that Recommendation 1.2/9 of the LIM NAT RAN Meeting 1976, while specifying the date of 5 October 1978 as the date of applicability of 60NM lateral separation within the MNPS airspace of the NAT Region, nevertheless contained a condition stating "unless another date was agreed between States and operators concerned and notified in due time to ICAO". When approving this Recommendation, the Council did so "on the understanding that, should an implementation date other than 5 October 1978 become necessary, ... an appropriate proposal for such a date would be presented for approval by Council". Therefore, even though no specific mandate had been given to the Group to make any pronouncement on this question, it nevertheless felt that it would be failing in its responsibilities if, at this Meeting, it did not express its view on the subject.

1.1.2 When discussing this matter and possible courses of action to be proposed, it became apparent that due to the short time since 29 December 1977, the date of introduction of the MNPS in the NAT Region, and up to the beginning of this Meeting of the Group, comparatively little data on gross errors had become available. In addition, when reviewing these gross errors, their causes and expected remedial action to some of them, it had been found that at least part of them were due to the use of navigation equipment which was in the process of being replaced by more modern equipment, thus probably preventing the repetition of such errors by the operator concerned due to the mal-functioning of the equipment in question.

1.1.3 In addition, the Group also realized that a purely mathematical-statistical application of observed gross errors to the mathematical model, upon which the MNPS concept was based, could not be accepted as the only basis for an operational decision as to whether safety in the MNPS airspace was impaired or not. While there was agreement that all observed gross errors (with the possible exception of those caused by transmission errors between ATC and pilots) would have to be included in the mathematical-statistical assessment of safety in the MNPS airspace, it was also evident that

the operational decision whether reduction of the separation to be applied in the MNPS airspace was feasible or not, should use the mathematical statistical assessment only as one of a number of factors used in such a decision-making process. The reason for this was that corrective action, required to avoid repetition of an observed individual gross error, could vary considerably depending on its causes and therefore different weighting would have to be applied to each in the determination of its probability of repetition (e.g. track deviations caused by NAV equipment failure versus those caused by mistakes in the insertion of relevant NAV data into the navigation computer, etc.)

1.1.4 Finally, the Group agreed that, once 60NM lateral separation was being applied in MNPS airspace, it would be necessary to ensure that monitoring of the overall navigation performance in the Organized Track System, and, to the extent possible, also in the remainder of the airspace of the NAT Region, would have to be extended as much as possible, both as to the geographical extent of monitoring and the amount of traffic monitored.

1.1.5 In view of this situation, the Group therefore felt that it should express its views and make proposals, as necessary, for action on the following questions:

a) should the amendment to the Regional Supplementary Procedures applicable in the NAT Region, permitting the application of 60NM lateral separation between aircraft meeting the MNPS and operating in MNPS airspace, be made applicable as of 5 October 1978?

b) should provider States concerned start to actually apply 60NM lateral separation as of the same date (i.e. 5 October 1978) when this became permissible in accordance with the applicable NAT RAC SUPPS?

c) what should be the procedure to be applied by provider States concerned to reach a common answer to question b) above and how should this be brought to the attention of parties concerned?

d) what additional measures were required to be taken to ensure the continued safe application of lateral separation between MNPS equipped aircraft while operating in MNPS airspace?

1.2 Application date of the NAT RAC SUPPS regarding the use of 60NM lateral separation in MNPS airspace

1.2.1 In view of developments regarding navigation performance in that part of the NAT Region where the MNPS became applicable as of 29 December 1977, the Group was unanimous in its views that there existed no valid reason which would militate against the retention of 5 October 1978 as the date at which it should become permissible to apply 60NM lateral separation between MNPS equipped aircraft while operating in MNPS airspace.

1.3 Actual application by provider States of 60NM lateral separation in MNPS airspace

1.3.1 The Group noted that, up to the beginning of this Meeting, information obtained on observed gross errors was such that practical application of 60NM lateral separation in MNPS airspace was likely to be possible as of 5 October 1978. In view of the expected trends indicated in paras. 1.1.2 and 1.1.3, there was reason to expect that the overall navigation situation would steadily improve. Taking into account that it would be possible to increase significantly data on observed gross errors during the next few months, the Group felt it advisable to propose that the decision by provider States to actually apply 60NM lateral separation on the date at which it became permissible should be delayed in the interest of gaining further supporting evidence for the correctness of such a decision.

1.3.2 In this respect, the Group noted a statement by IATA that notification of such a decision would only require advance notice of one AIRAC cycle (i.e. 7 September 1978) and it was therefore agreed that the decision by provider States could be made on a date not later than 11 August 1978.

1.4 Procedure to be applied by provider States to reach a common decision on the actual application of 60NM lateral separation in MNPS airspace

1.4.1 The Group agreed that the procedure to be applied by provider States (Canada, Iceland, Portugal, the United Kingdom and the USA) to arrive at a common decision whether 60NM lateral separation should actually be applied in MNPS airspace as of 5 October 1978, or at a later date, should cover the following steps, after appropriate consultation with representative user interests:

a) all States, capable of monitoring the navigation performance of aircraft operating in MNPS airspace, should conduct such monitoring on a regular basis and, in addition to the routine monitoring procedures, should, as of now and up to 31 July 1978, provide Canada, the Netherlands, the United Kingdom and the USA with all relevant information regarding observed gross errors in navigation;

b) the United Kingdom should collate that information in suitable form and make it available with an initial mathematical-statistical analysis to the provider States;

c) provider States should, on the initiative of the United Kingdom, hold a meeting between 1 and 10 August 1978 to:

i) determine definitively whether to actually apply 60NM lateral separation in MNPS airspace as of 5 October 1978 or not, taking into account the material provided by the UK in accordance with b) and all other relevant operational factors; and

ii) develop, as necessary, uniform procedures for application by ATC when using 60NM lateral separation.

d) provider States concerned should, on 7 September 1978, publish an AIRAC NOTAM Class II announcing the decision taken at the Meeting mentioned in c) above, together with any supplementary information required.

1.4.2 With respect to the increased monitoring activity to be undertaken in accordance with 1.4.1 a) above, the Group noted that, while Canadian, Irish and UK facilities, capable of doing so, had kept up their activities at a satifactory level, France and Iceland had joined in the radar monitoring of NAT traffic as of September 1977 and indicated that this would not be a matter of routine for their facility. Portugal stated that routine monitoring by Lisboa Radar had started as of 1 March 1978 and that radar monitoring by means of a military radar installation in the Azores had already been made on a limited scale and that negotiations were under way to extend this on a routine basis. In addition, the USA Member pointed out that measures were under way in his Administration which should permit routine monitoring of NAT traffic by all appropriate USA facilities before 5 October 1978.

1.4.3 As to the provision of data to Canada, the Netherlands, the United Kingdom and the USA it was pointed out that this should not only consist of information on gross errors observed, but for each gross error, any available details on the nature of the cause for such errors should be given together with any follow-up action taken, including supplementary information provided by operators regarding corrective measures, etc. By 31 July 1978, this should be supplemented by data on the total number of flights observed between now and that date.

1.4.4 In this connexion, it was also pointed out that gross errors reported either by the operators or by ATC, but not observed on radar, should be used as supplementary information in this operational decision-making process on the lateral separation to be actually used in the MNPS airspace.

1.4.5 Referring to Conclusion 13/4 of the 13th Meeting of the NAT/SPG and more especially the provision that, outside MNPS airspace, 120NM lateral separation was considered adequate even after the withdrawal of LORAN A facilities in the Region, the representative of IFALPA stressed that his Organization attributed importance to monitoring this type of separation in order to ensure its continued safety. The Group agreed that this was a continuing commitment.

1.4.6 As to the collation and initial analysis of the data provided to the United Kingdom in accordance with para. 1.4.1 b), it was understood that the United Kingdom would make necessary arrangements to have the required mathematical-statistical input from other interested States when conducting this analysis. In addition, the Group agreed that, further to the accepted mathematical-statistical method already applied on previous occasions, the material contained in Appendix A to this Summary should be taken into account.

1.4.7 As to the Meeting proposed to be held in accordance with para. 1.4.1 c) and the action to be taken by that Meeting, the Group agreed that:

a) the decision to actually apply 60NM lateral separation in MNPS airspace or not should take into account not only the mathematical-statistical assessment of the navigation situation as it presented itself at the time of the Meeting but also all other relevant operational considerations including discernible trends in development of the navigation environment as shown since January 1978;

b) necessary common ATC procedures regarding the application of 60NM lateral separation should be developed in as uniform a manner as was possible for use by all ATC units concerned. This should cover agreements on the nature of the revised Organized Track System, transition procedures for entry into and exit from the OTS at the boundaries of the NAT Region and all other relevant aspects.

1.4.8 With respect to b) above the Group noted that the amendment to the NAT RAC SUPPS proposed in Conclusion 13/17, i.e. to remove the limit between the two methods of application of lateral separation from 56N to 58N, had already formally been submitted to ICAO and was under active consideration. It was also noted that, in the light of evidence regarding the safety aspects of this matter presented by the UK Member, IFALPA withdrew its reservations to this proposal which it had stated at the 13th Meeting of the Group.

1.4.9 On a proposal of the Canadian Member it was also agreed that the NAT RAC SUPPS should be amended so as to require the insertion of the letter "X" after the letter "S" under Item 10 of the Flight Plan for flights by MNPS equipped aircraft through MNPS airspace in order to provide ATC units with a record that the flight was capable of complying with the MNPS. This proposal was already based on the new provisions regarding flight plans applicable as of 10 August 1978. The Group noted that Canada was prepared to submit this proposal formally to ICAO. (A proposed wording for the amendment of the NAT RAC SUPPS is contained in Appendix B to this Item).

1.4.10 The Group further agreed that it would be desirable to expand the provision regarding in-flight contingencies, now contained in the NAT RAC SUPPS so as to cover, in appropriate form, the action to be taken by pilots and by ATC in those cases where an aircraft, due to equipment failure, lost its MNPS capability while operating in MNPS airspace. Again, the Canadian Member agreed that Canada would formally submit such a proposal for the amendment of the NAT RAC SUPPS to ICAO and the proposed wording for such a proposal is contained in Appendix B to this Item. In addition, IATA and IFALPA proposed guidance material for pilots' action, covering the more likely cases of equipment failure, their consequences on the continued navigation of affected flights and recommended courses of action and the Group agreed that this material should be included in the NAT Guidance Material (Appendix C to this Item refers).

1.5 Additional measures required to ensure the continued safe application of lateral separation in MNPS airspace

1.5.1 As previously stated, the Group reaffirmed that continued and expanded monitoring by radar of the navigation performance of aircraft and appropriate follow-up by operators and States concerned constituted the major tool to permit a frequent assessment of the overall navigation performance and the safety of the lateral separation minima applied by ATC to MNPS aircraft while operating in MNPS airspace. It therefore agreed that, further to the measures agreed at the LIM NAT RAN Meeting (1976) on this subject, additional material prepared at this Meeting and covering monitoring activities as well as assessment of the data obtained through monitoring should be taken into account by those concerned. The relevant material is contained in Appendix D to this Item.

1.5.2 The Group further agreed that the whole subject of monitoring should be once more reviewed at its next Meeting.

1.6 Proposed future studies

1.6.1 While on this subject, IATA took the opportunity to request the Group that, at the earliest feasible time, studies should be undertaken to obtain further improvements of the traffic flow arrangements in the NAT Region so as to render flight operations more economic and eliminate penalties which may still persist. It proposed two specific subjects for study, namely:

a) the earliest practicable application of composite separation (i.e. 30NM lateral combined with 1000 feet vertical separation) between aircraft operating in the MNPS airspace; and

b) above FL290, the possibility of the use of 1000 feet vertical separation between aircraft which were on crossing tracks, thus reducing operational penalties to flights required to cross the main traffic flows in the Region.

1.6.2 With regard to a) above, the Group agreed that this would be kept in mind and that work on this subject would be undertaken as and when this became feasible in the light of circumstances.

1.6.3 With respect to the proposal in 1.6.1 b) above, the Secretary informed the Group that the matter of vertical separation above FL290 was now under world-wide review by the ICAO Panel on the Review of the General Concept of Separation (RGCS Panel) and that, up to this time, no difference was made between vertical separation between aircraft on crossing, joining, same direction or opposite direction tracks. It was therefore agreed to leave this matter to the discretion of those States and International Organizations being represented in the RGCS Panel, whether they wished to raise this subject there or not.

1.7 Conclusions

1.7.1 In view of the above, the Group concluded as follows:

CONCLUSIONS 14/1 - APPLICATION OF 60NM LATERAL SEPARATION BETWEEN MNPS EQUIPPED AIRCRAFT OPERATING IN MNPS AIRSPACE

That:

a) in the view of the Group, there existed no valid reason which could prevent ICAO from introducing on 5 October 1978, the amendment of the Regional Supplementary Procedures applicable in the NAT Region, permitting the use of a minimum lateral separation of 60NM between MNPS equipped aircraft in MNPS airspace;

b) Canada, Iceland, Portugal, the United Kingdom and the USA take a common decision, not later than 11 August 1978, whether their ATC units providing services in the NAT Region, will actually start to apply 60NM lateral separation as of 5 October 1978 or not, and publish this decision on 7 September 1978 by an appropriate AIRAC NOTAM (para.1.3 refers);

c) the States mentioned in b) above apply the procedure described in paras. 1.4.1 to 1.4.7 in order to reach the decision required in accordance with b) above and to take required supplementary measures resulting from this decision.

CONCLUSION 14/2 - PROPOSALS FOR AMENDMENT TO THE NAT RAC SUPPS

That the Regional Supplementary Procedures applicable in the NAT Region be amended as shown in Appendix B to the Summary of this Item and that the Member from Canada ensure that his Government will take necessary formal action with ICAO to this effect. (paras. 1.4.9 and 1.4.10 refer).

CONCLUSION 14/3 - MONITORING OF NAVIGATION PERFORMANCE OF AIRCRAFT AFTER THE INTRODUCTION OF 60NM LATERAL SEPARATION IN MNPS AIRSPACE

That, after the introduction of the 60NM lateral separation between MNPS equipped aircraft in MNPS airspace, those concerned with monitoring of the navigation performance of aircraft in the NAT Region take due account of the material contained in Appendix D to the Summary of this Item, supplementary to the general monitoring provisions developed by the LIM NAT RAN Meeting (1976).

Appendix A
to Item 1

SUPPLEMENTARY MATERIAL REGARDING THE MATHEMATICAL-STATISTICAL ASSESSMENT OF OBSERVED NAVIGATION ERRORS IN RELATION TO THE SAFETY OF AIR NAVIGATION

1. Introduction

1.1 The mathematical-statistical assessment of observed navigation errors in relation to the safety of air navigation depends essentially of two main factors. These are:

a) the determination of the collision risk; and

b) the nature of the analysis of data regarding the accuracy of navigation in the specific environment for which the assessment is made.

1.2 It should be noted that the collision risk model used for the MNPS has been set up for a parallel track environment and has been applied using data from the Gander and Shanwick areas. Thus, the results are primarily applicable to the Organized Track System (OTS) although it is very probable, on general considerations, that the situation outside the OTS but within the MNPS airspace is no worse. Clearly, it is important in the future to gather data similar to that from Gander/Shanwick to validate this assumption. Because of model and data limitations and the background of development of MNPS the following discussion of evaluation is primarily directed to the OTS.

2. Components of Collision Risk

2.1 The collision risk equation for parallel route structure used in the formulation of the MNPS approach can be written schematically in the form:

$$(\text{Collision risk}) = \begin{pmatrix}\text{Navigational}\\ \text{Performance}\end{pmatrix} \times \begin{pmatrix}\text{Traffic}\\ \text{factors}\end{pmatrix} \times \begin{pmatrix}\text{Aircraft}\\ \text{parameters}\end{pmatrix}$$

If the collision risk is to be constrained to the target level of safety then the product of the components of the right hand side of this equation must not increase significantly from the estimates used to derive the MNPS. The full description of the lateral collision risk equation and the system parameters used is given in ICAO Doc 9182 LIM NAT (1976), Appendix A to the Report on Agenda Item 1.2. The components of this equation are discussed hereafter.

Navigational Performance

2.2 The three MNPS constraints are formulated in such a way as to imply the need for monitoring. This should be carried out continuously for Gross Errors as observed by radar, while the standard deviation constraint requires "core" samples from time to time. Statistical methods will be used to assess the data against the MNPS criteria.

Traffic Factors

2.3 The dependence of collision risk on traffic is contained in two parameters, the same (Ey(S)) and opposite (Ey(O)) direction occupancies. These are the average number of aircraft on laterally adjacent (same, opposite) tracks at the same flight level within segments of length 240NM centred on the typical aircraft. In the MNPS formulation, based on total average flow of 400 flights per day (a NAT/TFG forecast for 1982), Ey(S) is at present taken as 0.5 and EY (O) as 0.013, using a simulation model for the allocation of aircraft tracks. Periodic data collections will be made to verify these values.

Aircraft Parameters

2.4 The phrase "aircraft parameters" includes such quantities as the sizes and relative velocities of aircraft, and the probability of aircraft nominally at the same flight level being in vertical overlap. The estimates of these quantities have been evolved in the normal discussion process in NAT/SPG. It would seem unlikely that there will be large changes in the values during the next few years. However, the possibility of this should not be ignored.

The Collision Risk Model

2.5 The mathematical model of Collision Risk used in the formulation of the MNPS concept (described in the Guidance material) is constructed on the basis of certain assumptions and approximations. The indications are that this model is "robust", i.e. that the accuracy of the results from the model are not critically affected by these assumptions. (A typical assumption is the mathematical "smoothness" of the statistical distribution of navigation deviations). It is also believed to be cautious and it is therefore important that a watch be kept on the data collected in the monitoring exercises from this point of view.

3. The Planned Reduction in Lateral Separation

3.1 In the development of the MNPS framework cautious estimates of the traffic factors and aircraft parameters are used in the collision risk equation. The assumptions inherent in the mathematical model are believed to represent the collision mechanism as it is understood at present. Thus in the short-term, the main issue is that of Navigational Performance. With regard to the change on 5 October 1978, results would clearly have to be available by the end of July.

3.2 The primary items which must therefore be monitored are Gross Errors (the half separation and full separation MNPS criteria), but the standard deviation of track-keeping errors should also be checked.

Gross Errors

3.3 The Gross Error frequency is specified in two ways in the MNPS constraints which focus on different magnitudes of navigational deviation from track. The crucial point is that the collision risk is directly proportional to the frequency with which relevant Gross Errors occur. If these frequencies are greater than the MNPS targets, the collision risk is similarly increased. For a given environment, such as the NAT Region, the total frequency of Gross Errors will vary with time, depending on the types of equipment in use, pilots' familiarity with the system, ATC system patterns and the improvements resulting from feedback from the monitoring programme. All such errors affect collision risk, but some of them may not be so relevant to the distance between adjacent tracks. Those types of errors which would constitute an equal risk for any lateral separation value may be excluded from the calculation, however, the excluded incidents would still need to be taken into account when considering the overall safe operation of the system and in the determination of appropriate corrective action.

3.4 One of the questions which must be answered before a reduction in lateral separation to 60NM can come into effect is that, given the types and frequencies of the Gross Errors observed in the monitoring programme, is the Gross Error picture compatible with the MNPS constraints? This is largely a statistical problem. There are several ways of tackling it. For example, it can be asked if the number of Gross Errors observed is significantly different from the average expected, should the MNPS constraints be met. The expression "significantly different" means outside the level of natural

statistical fluctuations. The wide range of results consistent with an expected rate is typical of the statistical fluctuation associated with rare events, which are generally supposed to occur according to the so-called Poisson distribution. The question can also be examined using "Sequential Testing" a method which has been put forward for assessing navigational performance. In this particular case the Poisson distribution would be used in the design of a nomogram from which judgements about the Gross Error process could be made, thus providing supplemental information upon which appropriate operational decisions regarding separation can be made.

3.5 The monitoring programme for Gross Errors within the MNPS airspace has been in operation since the beginning of this year. For the mid-August deadline this process has to continue and this will give information of the first half-year on Gross Errors. It should be noted that, for a proper analysis, not only the number of observed Gross Errors should be recorded, but also the total number of flights observed. From the point of view of gaining the maximum benefit from the monitoring process attention must be focused on the nature and, if possible, the causes of Gross Errors. Due to the restricted time scale the co-operation of airspace users will be invaluable in this latter respect.

The Standard Deviation Constraint

3.6 In giving consideration to lateral deviation from track, the constraint which relates to standard deviation is not primarily a requirement for limiting collision risk; rather it is a design requirement which indicates, prima facie, the suitability of a navigation system for MNPS airspace.

3.7 In the determination of the standard deviation a measurement accuracy of the order of 1NM is desirable thus it is considered that manual collection of the data would not achieve the desired results. Automatic collection of data directly from processed radar has already been planned and programmed as part of the proposed major longitudinal separation study to be conducted in Summer 1978. The same data could be used to give a measure of the lateral errors for Eastbound aircraft crossing the Shanwick OCA boundary. (Before the results can be interpreted, some indication of the accuracy of radar measurements is necessary.)

3.8 A small lateral core sampling exercise was carried out in July 1977 during the course of the pilot study for a longitudinal survey and the results were presented at NAT/SPG/13 as an Information Paper. That sample used only data obtained from Shannon Radar.

3.9 The intention is that in 1978 data will be obtained from Stornoway, Shannon and Mount Gabriel radars. All data collected would be made available for the lateral core checking, although it may not be necessary to analyse the total sample.

3.10 The sample would consist only of Eastbound aircraft, which will have spent less time on the ocean crossing than Westbound aircraft. For INS equipped aircraft, studies have shown that Eastbound crossings are likely to produce greater errors than Westbound, so that one-way sampling should provide a "worst case" situation. In the case of OMEGA, both the reception of stations and the fixing geometry are of a similar standard for both Eastbound and Westbound flights, hence one-way sampling should provide a representative case.

3.11 In order to determinewhether there is any difference in the performance of navigation systems used in the MNPS airspace, the navigation fits in the aircraft will be relevant. Airlines may be asked to help by giving details of navigation equipment in specific aircraft, particularly if unusual combinations of systems are in use, (e.g. two INS and one OMEGA). In cases of large errors, full trace action will be taken using flight progress strips in order to determine the possible cause of these deviations. An additional analysis will examine the variations in observed errors with the distance flown by the aircraft.

Appendix B
to Item 1

PROPOSED TEXTS FOR THE AMENDMENT OF THE NAT RAC SUPPS

1. Proposal to include, in Item 10 of the flightplan, an indication that the aircraft is capable of meeting the MNPS

1.1 Under Para. 4 of Part 1 of Doc. 7030 insert a new Regional Supplementary Procedure applicable in the NAT Region, as follows:

"Preceding the present para. 4.1.1 insert a new para

4.X Equipment

4.X.1 For flights intending to operate within MNPS airspace during any portion of their flight, the letter 'X' shall be inserted after the letter "S" in Item 10 of the flight plan, indicating that the aircraft is capable of complying with the MNPS (para.1.2 of the RAC SUPPS refers)."

2. Proposal to include pilot and ATC action in case of loss of MNPS capability by aircraft while operating within the MNPS airspace

2.1 In para. 6 of Part 1 of Doc.7030 amend the existing provisions in para. 6.1 and 6.2.1 as follows:

a) Amend the existing para. 6.1 to read as follows:

"6.1 The following procedures are intended for guidance to pilots and air traffic controllers only. Although all possible contingencies cannot be covered, they provide for the more frequent cases of:

a) inability to maintain assigned level due to weather, aircraft performance, pressurization failure and problems associated with high level supersonic flight; and

b) loss or significant reduction in the navigation capability when operating in parts of the airspace where a high accuracy of navigation is a prerequisite to the safe conduct of flight operations.

With respect to a) they are applicable primarily when rapid descent, turnback or both are required. In any case, however, the pilot's judgement shall determine the sequence of actions taken, and ATC shall render all possible assistance having due regard to the specific circumstances."

c) Amend the existing para 6.2.1 to read as follows:

"6.2.1 If an aircraft is unable to continue flight in accordance with its ATC clearance, including maintaining an accuracy of navigation on which the safety of the separation minima applied by ATC between it and adjacent aircraft depends, a revised clearance shall, whenever possible, be obtained prior to the pilot initiating any action, using the radio telephony distress or urgency signal as appropriate. Subsequent ATC action with respect to that aircraft shall be based on the intentions of the pilot as well as having due regard to the overall traffic situation as it exists at the time of occurence of the contingency".

GUIDANCE ON ACTION TO BE TAKEN BY PILOTS IF NAVIGATION EQUIPMENT FAILS BEFORE ENTERING OR WHILE IN MNPS AIRSPACE

1. Introduction

There are two requirements for aircraft planning to fly through the MNPS airspace (other than via specially designated routes) :

1) one refers to the performance which should be achieved (as a result of the procedures and long-range navigation systems on-board);

2) the other refers to the need to carry stand-by equipment with comparable performance characteristics.

Some aircraft carry equipment which exceeds the second of these requirements (e.g. they have 3 INS) and in their case, if one system fails even before take-off, the two basic requirements may still be satisfied, and the flight can proceed normally. For aircraft with only two operational systems, the following guidance is offered in respect of the two general areas of failure.

2. One system fails before the OCA boundary is reached

2.1 The pilot will have to consider:-

i) landing at a suitable aerodrome before the boundary or returning to the aerodrome of departure;

ii) diverting via one of the special routes which have been recommended for use by aircraft suffering partial loss of navigation capability;

iii) obtaining a reclearance below the MNPS airspace or (less likely) above the MNPS airspace.

2.2 The controller will issue an appropriate ATC clearance.

3. One system fails after the OCA Boundary is crossed

3.1 Once the aircraft has entered Oceanic airspace the pilot should normally continue to operate the aircraft in accordance with the Oceanic clearance already received.

However, he should:

i) assess the prevailing circumstances (e.g. performance of the second system, remaining portion of flight in MNPS airspace, (etc.);

ii) exercise his judgement with respect to the prevailing circumstances (e.g. request clearance above or below MNPS airspace, reverse course, obtain reclearance to the special routes, divert to a suitable aerodrome, etc.)

iii) consult with ATC (with respect to the options under consideration) so the most suitable action can be selected;

iv) obtain appropriate ATC clearance prior to any deviation from the current Oceanic clearance.

3.2 The controller will:

i) suggest alternatives which appear reasonable in the circumstances; and

ii) issue an ATC clearance covering the stated intention of the pilot, to the extent that this is practicable.

3.3 When the flight continues in accordance with its original clearance, (especially if the distance ahead within MNPS airspace is considerable):

3.3.1 The pilot should begin a special monitoring programme:-

i) to take special care in respect of the operation of his remaining systems, taking account of the fact that his routine method of cross-checking against the second system is no longer available;

ii) to check the main and standby compass systems against the information which he has available; and

iii) to check the performance record of his remaining equipment and if doubt arises regarding the performance and/or reliability he should consider:

a) attempting visual sighting of other aircraft or their contrails which may provide a track indication; and

b) calling the appropriate OAC to obtain information on aircraft adjacent to his estimated position and/or calling on VHF to establish contact with such aircraft (preferably same track/level) obtaining from them information which could be useful (e.g. drift, magnetic heading, wind details).

4. The remaining system fails after entering Oceanic airspace.

(or, the remaining system gives an indication of degradation of performance or, neither system fails completely but the systems indications diverge widely and the defective system cannot be determined).

4.1 The pilot should:

i) notify ATC;

ii) make best use of the procedures specified in 3.3.1 iii) a) and b) above;

iii) keep a special look out for possibly conflicting aircraft and make maximum use of outside lights.

iv) if no instructions are received from ATC within a reasonable period consider:

a) consider climbing or descending 500 feet;

b) broadcast action taken on 121.5 MHz; and

c) advise ATC as soon as possible.

4.2 The controller, when advised that there has been a complete loss of long-range navigation capability will:

i) issue appropriate clearances;

ii) issue warning messages to aircraft in the presumed vicinity; and

iii) assign a special transponder code to the aircraft to facilitate its early identification.

CONTINUED AND EXTENDED MONITORING PROGRAMME OF NAVIGATION PERFORMANCE AFTER THE INTRODUCTION OF 60NM LATERAL SEPARATION IN THE MNPS AIRSPACE

1. Intrpduction

1.1 The material hereafter is supplementary to the general monitoring provisions developed by the LIM NAT RAN Meeting(1976) and contained in the Report of that Meeting. It covers supplementary monitoring requirements following the practical application of 60NM lateral separation between MNPS equipped aircraft while operating in MNPS airspace.

1.2 Attachment 1 to this Appendix contains an approximate time scale for the conduct of specific monitoring exercises and their assessment over the next two years.

1.3 In order to render recording, follow-up action and assessment of gross errors as simple as possible, a uniform format for the notification of gross errors to operators and States of Registry, as required, both by letter and/or by teletype message, has been developed for use by all monitoring facilities. The message formats are shown in Attachment 2 to this Appendix.

2. Navigational Performances

2.1 The monitoring of Gross Errors is a continuous exercise. As data accumulate the available statistical methods will make it possible to assess the level of risk more accurately and to identify any trends which might occur. Monitoring activities should also cover whether there is a relationship between Gross Error frequency and track length and whether there are differences in navigation accuracy between aircraft operating on the OTS and those operating outside the OTS. The standard deviation of the lateral core should be measured regularly, e.g. at annual intervals, unless there is some indication that more frequent examination is necessary.

3. Traffic Factors

3.1 The exercise described in Attachment 3 to this Appendix estimates the occupancies for the current system which is based on Gander/Shanwick data. When the 60NM separation comes into effect this will need to be repeated to take account of any changes resulting from the new ATC track system. With the present time scales, this should take place in the summer of 1979 and be repeated every few years. As already mentioned, data of a similar nature will also be required for traffic outside the OTS.

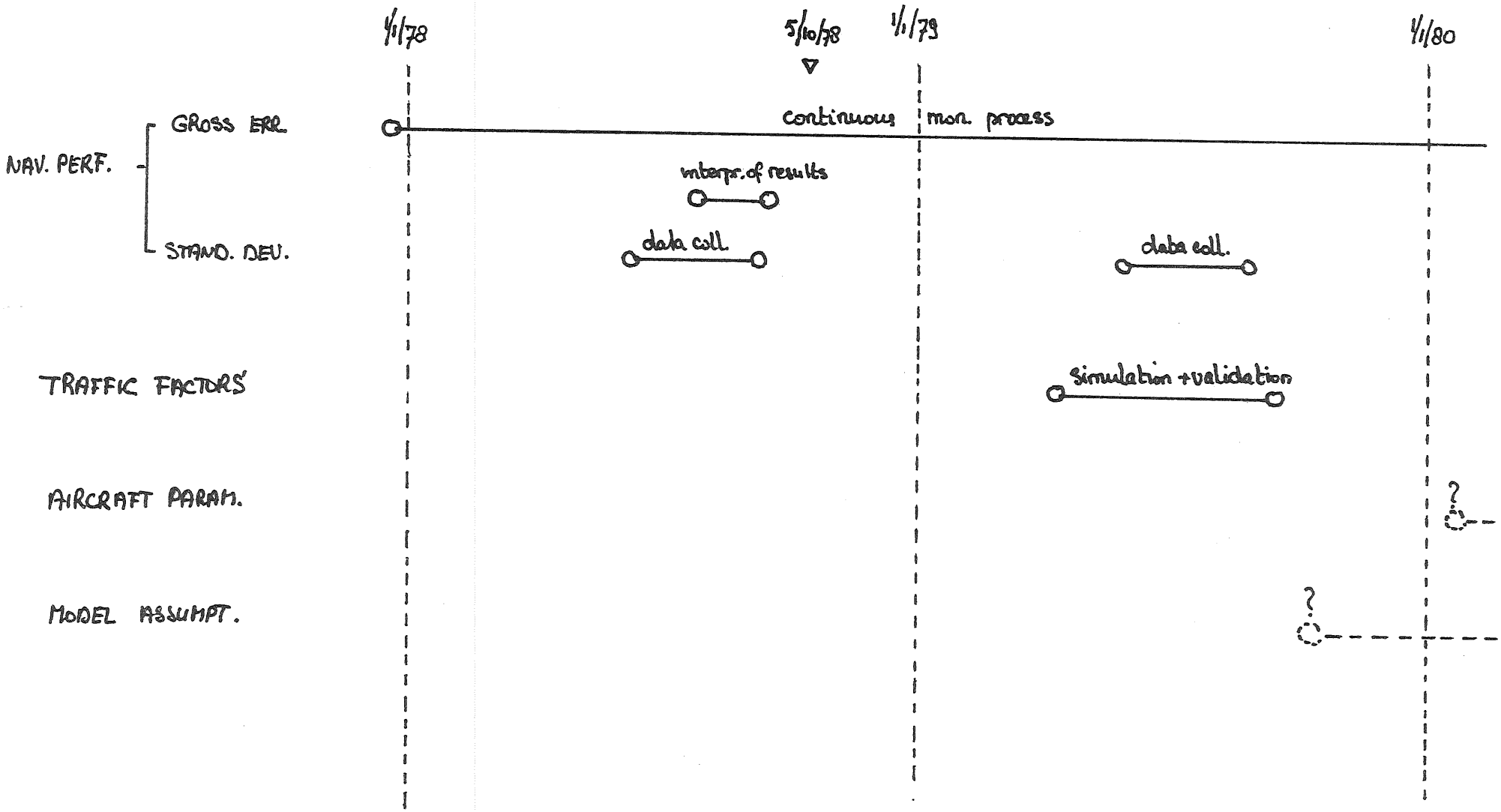
4. Aircraft Parameters

4.1 Under this subject, the aircraft dimensions and the average relative speeds between pairs of aircraft are assembled. For most of these parameters the present values can continue to be used for at least several years to come. The relative longitudinal speed value will be verified during the longitudinal data collection which is now being planned.

5. Collision Risk Model Assumptions

5.1 The assumptions inherent in the MNPS collision risk model formulation cannot be formally monitored: what is required is that the Gross Errors, traffic patterns, etc., be examined as information becomes available to determine if the model needs to be revised. Thus, any observed phenomena which could not be attributed to the stochastic collision process upon which the theoretical structure of the model is based would require a revision of the model.

ROUGH TIME PLANNING OF THE DIFFERENT TYPES OF MONITORING



Attachment 2
Appendix D

MESSAGE FORMATS FOR NOTIFICATION OF GROSS ERRORS TO OPERATORS BY MONITORING AUTHORITIES

1. The following is the proposed format for a letter to the operator of an aircraft (and, if required, to the State of Registry) having been observed to have committed a gross error in navigation :

GROSS NAVIGATION ERROR

Dear Sir,

States responsible for the provision of air traffic services in the North Atlantic Region have been instructed by ICAO to monitor and notify operators and States concerned of aircraft deviations of 25NM or more from assigned track so that they may take prompt and effective action to prevent a repetition.

A gross navigational error has been reported in respect of the following flight :

Aircraft Identification: Type:

Departure: Destination:

Date: Cleared Track:

Cleared flight level:

The notification should then contain information on the following:

- Radar observed position and time
- Displacement from cleared track
- action taken by ATC (if any)

Comments by crew on being notified of error:

Other comments:

Detailed explanations should be provided on the attached Error ~~Report~~ Investigation Form and are ~~and the~~ In your reply, you are also requested to indicate the

An ~~investigation and explanation~~ of this gross navigational error is requested. ~~The explanation should specify the type of navigation equipment fitted and any corrective action taken should be specified.~~

Yours faithfully,

2. If notification of a gross error is made by teletype message, this should contain the information given in the letter and in the same order.

3. Up to 31 July 1978, a copy of each such letter or teletype message, as well as copies of any subsequent correpsondence on the incident in question should also be sent to:

CANADA

Director, Air Traffic Services
Attention: ATN
Transport Canada
Ottawa, Ontario
KIA ON8

Teletype: CYOWYY
ATTN: ATN

NETHERLANDS

Civil Aviation Administration
Attention: Chief Operations ATS
Ministry of Transport and Public Works
Plesmanweg 1-6
The Hague

Telex: 31435

UNITED KINGDOM

Civil Aviation Authority
Room T 1115
Space House
43-59 Kingsway
London WC2 B6TE

Telex: 883092

USA

Federal Aviation Administration
Air Traffic Service
International Operations and Procedures Branch,
AAT - 310
800 Independence Avenue S.W.
Washington D.C. 20591

DATA REQUIREMENTS FOR OCCUPANCY ESTIMATES

1 Previous work on estimates of the occupancy parameters, Ey(S) and Ey(O), for the NAT region, is contained in three RAE reports:

P P Scott RAE Technical Reports	68097 (1968) - Studies of Traffic Packing for estimating Mid-air Collision Risks over the North Atlantic
	73180 (1974) - A simulation model of Air Traffic Allocation to the North Atlantic Track System
R S Shiel RAE Technical Memorandum	7703 (1977) - Study of Traffic Packing over the North Atlantic.

2 The data required for the estimation of the occupancies was taken from Air Traffic Control records supplied by the authorities at Prestwick and Gander. Figure 2 of Scott's first report shows a sample data card, derived from flight progress strip records. Both Scott and Shiel used data for twenty-five samples of traffic, each taken for a period of 24 hours. The data periods gave representative coverage for days of the week, low, average and high traffic, and varying meteorological conditions.

3 These data enable the variation of occupancy E with traffic flow rate D to be calculated. In his first paper Scott used linear regression to determine the constant A in the relationship $E = AD$. With this relationship the values of the occupancies for higher traffic flow could be estimated.

4 In the two later papers a simulation model was used to predict occupancy for higher traffic levels, after being validated against the observed occupancies. The simulation model is used because as flow rate increases the linear regression becomes over-cautious as there are finite bounds on occupancy values.

5 This simulation model is also used in calculations of economic aspects of the track system. A UK Working Paper prepared by Mr V Attwooll describes aspects of this model in connection with assessing the economic gains from the proposed separation reduction. Essentially the data required is of flight path request patterns and preferences.

Agenda Item 2: Review of the situation with regard to the provision of special routes; and temporary arrangements for aircraft unable to comply with MNPS.

2.1 Introduction

2.1.1 The Group noted that practical experience gained since the introduction of the MNPS airspace with the arrangements for special routes and related procedures, and also with the special temporary arrangements for aircraft unable to comply with the MNPS, had shown a need for the revision of the arrangements made at the 13th Meeting of the Group and for modifications in the light of the actual situation.

2.1.2 Under this item the Group therefore made a review of the following three aspects:

a) establishment of special routes and related procedures;

b) special temporary arrangements for aircraft unable to comply with the MNPS; and

c) extension of the provisions under b) for specific flights.

2.2 Establishment of special routes and related procedures

2.2.1 At the 13th Meeting the provisions for the establishment of special routes (para. 1.5 of Summary/13 refers) had been sub-divided into three parts as follows:

a) routes between Iceland and other parts of Europe;

b) routes between North-Eastern Canada and Iceland via Greenland; and

c) possible routes for aircraft suffering partial loss of their navigation capability prior to entering the MNPS airspace.

At that time specific arrangements had been proposed in Conclusion 13/2 regarding a) above, while the provisions covering b) had been left in a more loose form and the provisions covering c) had only been proposed as guidance because of the large variety of circumstances which may exist whenever a specific case falling within the provisions of c) arose.

2.2.2 At the 13th Meeting it had also been noted that, IFALPA had reserved its position on the two cases in b) and c) above, because it felt that this could lead in practical operation, to a reduction in the level of safety.

2.2.3 At this Meeting, the Group therefore agreed to review the relevant provisions in detail and to tighten up the procedures so that pilots and ATC were provided with more specific directives on how to plan flight operations when taking advantage of the special provisions and how to control such flights.

2.2.4 In this context, the Group also recalled that, at the 13th Meeting, the representative of Portugal had informed the Group that his Administration was engaged in studies to determine the feasibility of authorizing aircraft provided with normal short-range navigation equipment and at least one fully operational set of one of the following:

i) DOPPLER with computer

ii) INS

iii) OMEGA

to conduct flights through MNPS airspace between specific points in Portuguese territories. At this Meeting the Group was informed that these studies had now been completed and had shown the feasibility of this proposal. It was therefore agreed that three specific routes between points in Portuguese territories should be included in the list of special routes on which aircraft, equipped as stated above, should be considered capable of meeting the MNPS.

2.2.5 The revised provisions, developed at this Meeting and replacing in toto those contained in para. 1.5 of the Summary on Item 1 of the 13th Meeting are contained in Appendix A to this Item.

CONCLUSION 14/4 - ESTABLISHMENT OF SPECIAL ROUTES AND RELATED PROCEDURES

That the material contained in Appendix A to the Summary of this Item replaces in toto the material contained in para. 1.5 of the Summary of Discussions and Conclusions of the 13th Meeting of the NAT/SPG (pages 1-6 to 1-10 of NAT/SPG Summary/13 refers).

2.2.6 While on this subject, the Group was informed that, in accordance with the provisions of Conclusion 13/2 of the 13th Meeting, Iceland had submitted a proposal for amendment of the NAT and EUR Regional Plans covering the establishment of the routes mentioned in sub-para a) of that Conclusion and the associated radio aids to navigation. Subsequently three States had commented on this proposal, two of them (Norway and the UK) questioning the need for implementation of one of the routes in the lower airspace and one State (the USA) objecting to the need for the addition of a DME to a VOR in Iceland (Ingo VOR), included in the proposal as a supporting radio navigation aid, and questioning the need for the retention of an LF/MF aid in the vicinity of that VOR (NDB Hornafjordur).

2.2.7 While the Group was fully aware that it was not entitled to involve itself in matters which were under formal consideration within ICAO, it was nevertheless believed useful to take advantage of the presence of representatives from the four States directly involved in this matter, in order to have an exchange of views which might be of assistance in the resolution, within ICAO, of the differences of opinions which had come to light.

2.2.8 In the ensuing brief discussion it was noted that there were differences in opinion regarding the usefulness of the addition of a co-located DME to the VOR Ingo, even though the representative from Iceland pointed out that this DME, which was in operation since 1975, had proved very useful to ATC in order to resolve separation problems regarding opposite direction traffic on ATS route G3 and those caused by traffic crossing that route over the High Seas South of Ingo. It was also mentioned that this DME might be used by operators engaged in sub-polar operation to up-date their INS equipment. There was, however, unanimous support for the deletion of the NDB Hornafjordur.

2.2.9 It was noted that Iceland would present a revised proposal to ICAO which took account of the points made during the discussion.

2.3 Special Temporary Arrangements for Aircraft unable to Comply with the MNPS

2.3.1 With regard to the special temporary arrangements for aircraft unable to comply with the MNPS as developed at the 13th Meeting (para. 1.6 of Summary/13 refers), the Group found that:

a) in the light of discussions reflected in the Summary of Item 1;

b) because of certain developments regarding retro-fit of new navigation equipment by certain operators; and

c) because of practical experience gained with the application of certain exemption procedures;

it would be necessary to amend these provisions so as to render them more efficient in practical application.

2.3.2 The modifications made at this Meeting referred essentially to the following three aspects:

a) the possible prolongation of certain provisions, now limited to 5 October 1978, in case actual application of 60NM lateral separation in MNPS airspace was decided to be postponed by the provider States concerned;

b) the elimination of certain provisions regarding aircraft equipped with DOPPLER/LORAN C navigation equipment after 60NM lateral separation was actually being applied within MNPS airspace; and

c) the extension of and modification of the special arrangements, now limited in application to the end of December 1978.

2.3.3 With regard to b) above, it was noted that the retro-fit programmes of certain operators were progressing more rapidly than expected and it appeared therefore not necessary to continue these provisions to the end of 1978. In addition, the Group wanted to make it clear than planning by operators for new navigation equipment for aircraft, intended to be used for operations in MNPS airspace, should definitely not be based on these provisions.

2.3.4 As to the provisions in c) above, it was felt that, in exceptional cases, their application should be maintained even after the end of 1978, but that their application should be made dependent on support by the State of Registry of the operator wishing to take advantage of the provisions. The Group emphasised that such cases should be rare and relate to genuine emergencies (e.g. earthquake relief flights).

2.3.5 The revised provisions, developed at this Meeting, and replacing in toto those contained in para. 1.6 of the Summary on Item 1 of the 13th Meeting, are contained in Appendix B to this Item.

CONCLUSIONS 14/5 - SPECIAL TEMPORARY ARRANGEMENTS FOR AIRCRAFT UNABLE TO COMPLY WITH THE MNPS

That the material contained in Appendix B to the Summary of this Item replaces in toto the material contained in para 1.6 of the Summary of Discussions and Conclusions of the 13th Meeting of the NAT/SPG (pages 1 - 10 to 1 - 12 of NAT/SPG Summary/13 refer).

2.4 Extension of special temporary arrangements for aircraft unable to comply with the MNPS

2.4.1 The Group was informed that, since the introduction of the MNPS, it had been noted that there existed a number of small turbo-jet aircraft which were used for IGA operations across the North Atlantic and which, due to their performance characteristics, wished to operate at flight levels above the upper limit of the MNPS airspace (FL410 and above). However, depending on their point of departure, this required comparatively brief penetration of the MNPS airspace. Because of this, such of those aircraft which were not MNPS equipped were, under the existing provisions, excluded from operating at their most economic cruising levels. It had, however, also been noted that, in some cases, such aircraft were, for the portion of their flight in MNPS airspace, still within radar coverage of the ATC unit controlling these flights and/or within the usable operational coverage of VORs. They could therefore obtain sufficient track guidance to make this short penetration of MNPS airspace a feasible proposition.

2.4.2 In the ensuing discussion, it became apparent that, if a solution were to be found for these flights, it would be necessary to reconcile two apparently opposing conditions, i.e. the formal resolution not to weaken in any way the concept upon which the MNPS were based as against the need to cater for a legitimate operational requirement of a limited number of NAT airspace users. Considering the relative weight of these two apparently contradictory conditions, and taking into account the fact that these operations were few in number and the application of any special provisions for these flights would therefore, and because of the conditions imposed on such flights, be restricted to very few and small areas of the Western border of the NAT Region, the Group agreed to propose the following provisions for such flights on the understanding that this would be published in appropriate aeronautical information publications by States concerned.

CONCLUSION 14/6 - SEPCIAL ARRANGEMENTS FOR THE PENETRATION OF MNPS AIRSPACE IN THE NAT REGION BY AIRCRAFT INTENDING TO OPERATE ON TOP OF THE MNPS AIRSPACE WITHIN THE NAT REGION

That provider States concerned:

a) apply the following procedure:

"Aircraft not equipped for operation in MNPS aispace may be cleared by the responsible ATC unit to climb or descend through MNPS airspace provided:

i) the climb or descent can be completed within the usable coverage of selected VOR/DMEs and/or within the radar coverage of the ATC unit issuing such clearance and the aircraft is able to maintain direct pilot-controller communications on VHF; and

ii) MNPS aircraft operating in that part of the MNPS airspace affected by such climb or descent are not penalized by the application of this procedure."

b) publish this procedure in appropriate aeronautical information publications stating the VOR/DMEs to be used and indicating those parts of the MNPS airspace which may be affected by this procedure.

2.5 Co-ordination between ATC units in the application of the above procedures

2.5.1 In the course of discussion on the revised procedures, as recorded above, the Group noted that, in the past, certain difficulties had arisen because of differences in the interpretation and application of existing procedures by those ATC units engaged in the provision of services in the NAT Region. It was therefore believed advisable that, as soon as possible, arrangements should be made to permit suitably qualified representatives from OACs to convene a meeting at which uniform instructions for the application of the revised procedures could be developed. It was felt that the Meeting proposed in accordance with Conclusion 14/1 c) (para. 1.4.1 c) refers) would offer such a possibility.

Appendix A
to Item 2

PROVISIONS REGARDING ESTABLISHMENT OF SPECIAL ROUTES AND RELATED PROCEDURES

(Note: The material in this Appendix replaces in toto that contained in para. 1.5 of the Summary of Discussions and Conclusions of the 13th Meeting of the NAT/SPG (pages 1-6 to 1-10 of NAT/SPG Summary/13 refer)).

1. Establishment of special routes and related procedures

1.1 The Group noted that Annex 6, Part I, Chapter 7 stated a requirement for aircraft to carry stand-by navigation equipment. In the context of the application of the MNPS, as agreed at the LIM NAT RAN Meeting (1976), this could be interpreted to mean that, while two sets of long-range navigation equipment would have to be carried when operating in the major part of the MNPS airspace, there could be some areas where the requirement to carry stand-by equipment need only apply to that used for short-range navigation.

Routes for flights by aircraft with short-range NAV equipment between Iceland and other parts of Europe

1.2 After a careful review of the navigational guidance provided on the route from Bergen (Flesland) via Myggenes and Ingo to Keflavik and on the route from Sumburgh via Akraberg to Myggenes, the Group agreed that aircraft provided with normal short-range navigation equipment (VOR/DME, ADF) operating on these routes within MNPS airspace should be considered capable of meeting the MNPS. In addition, it was agreed that these two routes should be published in the appropriate aeronautical information publications of States concerned and that they should be given the designation G3 and G11 respectively.

1.3 The Group noted that, after the 13th Meeting of the NAT/SPG, Iceland had submitted a proposal for amendment to ICAO to include the routes in question in the NAT and EUR Regional Plans. At the time for the 14th Meeting, this proposal was still under consideration by States concerned.

Routes between North-Eastern Canada and Europe for aircraft not equipped for routine operations throughout MNPS airspace

1.4 The Group agreed that aircraft which are equipped with normal short-range navigation equipment (VOR/DME, ADF) and at least one fully operational set of one of the following navigation equipment:

i) DOPPLER with computer

ii) INS

iii) OMEGA

iv) LORAN C

should be considered capable of meeting the MNPS while operating along the following routes:

a) STN/BEN-60N10W - 61N1234W -LIMA - KF

b) BEL-57N10W-60N15W-61N1630W-MIKE-KF

c) KF-X-RAY-KK-SF-FB

d) KF-UNIFORM-63N30W-61N40W-OZN

e) OZN-59N50W-PRAWN-KL

f) OZN-59N50W-PORGY-HO

g) OZN-58N50W-LOACH-YR

on the understanding that direct flights from North-Eastern Canada via Greenland and Iceland direct to Europe and vice versa could also operate on those routes specified in para. 1.2 above for the portion of their flight between Iceland and other parts of Europe.

Routes between specific points in Portuguese Territories

1.5 The Group agreed that aircraft which are equipped with normal short-range navigation equipment (VOR/DME,ADF) and at least one fully operational set of one of the following navigation equipment:

i) DOPPLER with computer

ii) INS

iii) OMEGA

should be considered capable of meeting the MNPS while operating along the following routes:

a) PST-35N20W-FOXTROT TWO-VSM

b) CP-3820N15W-38N20W-ECHO/DELTA-VSM/MGL

c) CP-3853N15W-39N20W-BRAVO-LM

Measures to be taken by aircraft suffering partial loss of their navigation capability prior to entering the MNPS airspace

1.6 In the event of an aircraft suffering partial loss of navigation capability prior to entry into oceanic airspace, the pilot should consider using the routes specified in para. 1.4 above subject to the following conditions:

a) sufficient navigation capability remains to meet the MNPS and the requirements in Annex 6, Part 1, Chapter 7 can be met by relying on the use of short-range navigation aids;

b) a revised flight plan is filed with the appropriate ATS unit; and

c) an appropriate ATC clearance is obtained.

Note 1: A revised oceanic ATC clearance will be issued after co-ordination between all OACC's concerned.

Note 2: Should the organized track system at the time of the incident extend to the Northern part of the NAT Region, the aircraft concerned may be required to accept a lower than optimum flight level in its revised oceanic clearance, especially during peak traffic periods.

Note 3: The above guidance material in no way relieves the pilot from the obligation to take the best possible course of action in the light of prevailing circumstances.

1.7 The Group agreed that the above provisions should be included in a revised edition of the "Guidance and Information Material concerning Air Navigation in the NAT Region" at the earliest suitable opportunity in replacement of the material developed at the 13th Meeting of the Group and now contained therein.

Appendix B
to Item 2

SPECIAL TEMPORARY ARRANGEMENTS FOR AIRCRAFT UNABLE TO COMPLY WITH MNPS

(Note: The material in this Appendix replaces in toto that contained in para. 1.6 of the Summary of Discussions and Conclusions of the 13th Meeting of the NAT/SPG (pages 1-10 to 1-12 of NAT/SPG Summary/13 refer))

1. Special temporary arrangements for aircraft unable to comply with MNPS

1.1 The Group noted that, at the LIM NAT RAN Meeting (1976), it had been requested to develop arrangements for specific aircraft initially unable to comply with the MNPS but needing to operate within the MNPS airspace, and that such arrangements should not exceed a maximum period of 12 months starting from the time the MNPS became applicable in the NAT Region, i.e. 29 December 1977 (Recommendation 1.2/10 sub para. 5) refers).

1.2 During the initial discussions of this subject at its 13th Meeting, the Group had believed that it would be sufficient to divide arrangements into two phases only, i.e. the one covering the period from 29 December 1977 to 5 October 1978 and the other from then to the end of December 1978. However, subsequent developments at the 14th Meeting of the Group revealed a need for a revision of these arrangements to take account of:

a) the fact that actual application of 60NM lateral separation may not be applied as of 5 October 1978 by the provider States concerned but may be postponed to a later, commonly agreed date;

b) developments in the retro-fit programmes of certain operators had been more favourable than anticipated, thus eliminating the need for retention of the provisions regarding aircraft equipped with DOPPLER/LORAN C after the date of actual application of 60NM lateral separation; and

c) the prolongation beyond the end of December 1978 and modification of the provisions catering for justified special operations by non-MNPS equipped aircraft through MNPS airspace.

1.3 In developing proposals for the period between 29 December 1977 and the date of actual application of 60NM lateral separation, account was taken of the fact that during that period a lateral separation, of 120NM would continue to be applied between aircraft, and that this had therefore a definite effect on the arrangements proposed. In addition, the information on re-equipment efforts made by operators, required to operate in the MNPS airspace, as recorded in para. 1.2 above, seemed to indicate that the number of aircraft requiring to make use of such arrangements will have significantly diminished by that time.

1.4 For the period after the time a reduced lateral separation of 60NM will be applied, the Group felt that the arrangements would only have to cater for a very small number of requests for such operations under exceptional circumstances.

1.5 It was noted that due to the use of automated data processing equipment by OACs and particularly at OAC Gander, extensive re-programming of such equipment with appropriate lead times was required prior to the application of reduced lateral separation in the NAT Region.

1.6 In view of the above the Group updated its previous agreement as follows:

a) on the understanding that the requirement to comply with the MNPS in that part of the NAT Region designated as MNPS airspace became applicable as of 0001 GMT on 29 December 1977, aircraft intending to operate within the MNPS airspace are required to fully meet the MNPS, except when the provisions in b) and c) apply;

b) aircraft currently equipped with DOPPLER/LORAN C navigation equipment may be authorized to operate within the MNPS airspace during the period from 0001 GMT on 29 December 1977 to the date when 60NM lateral separation is actually being applied in MNPS airspace;

c) after 0001 GMT on 29 December 1977, aircraft equipped with navigation equipment other than that meeting the MNPS unless using DOPPLER/LORAN C equipment, should not be authorized by their State of Registry to operate within the MNPS airspace, except in accordance with the provisions specified in b) and d);

d) after 0001 GMT on 29 December 1977, special arrangements may be made for a limited number of individual and exceptional cases to permit aircraft not meeting the MNPS to operate within or through MNPS airspace on the understanding that such arrangements require co-ordination between the operator requesting such operations and the OAC of entry of such flights in the MNPS airspace with adequate advance notice. In addition, such requests should be supported by an authoritative source of the State of Registry of the operator concerned. The ultimate decision on the method of handling such aircraft should be made by the ATC authorities of the OAC of entry after appropriate co-ordination with all other OACs concerned by their operation, taking into account all relevant factors, including the navigation capability of the aircraft concerned. In addition, such arrangements should be made in such a way that they result in the least economic penalties for aircraft complying with the MNPS and being affected by such operations.

1.7 With regard to those aircraft restricted from operation within the MNPS airspace, the Group agreed that, because of the very low traffic density outside the MNPS airspace, it will be safe to continue to apply the present value of 120NM lateral separation between them. Developments in this respect will, however, be kept under close observation by ATC provider States in the Region and, should a significant increase in traffic over the expected number occur, this will be reviewed by the Group with a view to develop appropriate measures.

1.8 The Group agreed that the above provisions should be included in a revised edition of the "Guidance and Information Material concerning Air Navigiation in the NAT Region" at the earliest suitable opportunity in replacement of the material developed at the 13th Meeting of the Group and now contained therein.

Agenda Item 3: Review of work undertaken on the question of crossing and joining traffic in the NAT Region.

3.1 General

3.1.1 At its 13th Meeting, the Group had devoted, once more, some considerable time to the continuous problems caused by and to traffic crossing or joining the major, predominantly East-West orientated, traffic flow in the NAT Region and, in the light of commitments made at that time by a number of provider States, this subject had been included in the Agenda of this Meeting in the hope that progress, made since the 13th Meeting, would permit this 14th Meeting of the Group to develop specific proposals for action.

3.1.2 In view of this situation, it had also been decided prior to the 13th Meeting, not to invite Trinidad and Tobago and Venezuela to participate in the 13th Meeting (as called for in Recommendation 6/15 of the CAR/SAM RAN Meeting 1976) on the understanding that this would be possible at the 14th Meeting of the Group. Unfortunately, a survey conducted amongst Members of the Group prior to the 14th Meeting showed that progress achieved in this field was not such as to warrant such an invitation. (See also para. 1.1.2 on page ii of this Summary).

3.2 Discussion

3.2.1 At this Meeting, the Group noted that problems with regard to traffic operating from the Northern and Southern parts of Europe and joining the Organized Track System in mid-Atlantic still persisted. This applies also to any other traffic crossing or joining the OTS.

3.2.2 When considering possible solutions to this latter problem, it was found that there existed no simple way of resolving this question, especially in view of the fact that the representative of Spain made it clear that his Adminstration was not prepared to accept additional penalties to flight operations out of Iberia across the North Atlantic, over and above those which had already to be accepted as a consequence of the conflict of these operations with the main, East-West oriented, traffic flow in the Region between Europe and the North American continent. Proposals for a more flexible application of the existing arrangements regarding the accommodation of the various traffic flows, including the most effective use of the airspace in the Region revealed rapidly that these would require such an amount of detailed and specialized work by people directly

concerned with these problems in day-to-day operations that it became unlikely that this could be done within the scope and time-frame of a normal NAT/SPG Meeting. In addition, it was noted that the preliminary contacts between the USA and its Southern neighbours on the Western side of the Region had not yet progressed to the point where the impact of arrangements made by them on the traffic flow in the entire Sourthern part of the NAT Region could be assessed:

3.2.3 In view of this situation, the Group agreed on the following course of action:

a) the USA should accelerate, to the maximum extent possible, preliminary co-ordination with its Southern neighbours,, and particularly Trinidad and Tobago and Venezuela, in order to develop a common view on the method of handling traffic operating between Europe and the Caribbean Region and points beyond. (It was noted that the North American Regional Office of ICAO had offered its assistance in the conduct of this co-ordination, if so desired by the States concerned);

b) upon completion of the work under a) above, a working group composed of Canada, France, Portugal, Spain the United Kingdom, the USA and IATA (together with any additional representation from the Caribbean Region as required), should be convened to develop, as soon as possible, proposals for the accommodation of the different traffic flows South of the Organized Track System, including those joining or crossing the OTS from the South..

c) upon completion of the task under b) above, a suitably composed working group should look at the problems caused to traffic joining the Organized Track System from points of origin in the Northern part of Europe, applying to this task the experience and methodology adopted for the work to be undertaken under b).

3.2.4. As to the work to be conducted in accordance with b) above, the Group noted that IATA would try to provide computer-produced consolidated traffic presentations which should permit the group in question to obtain a better appreciation of the planned ideal versus the actual traffic flow under specified conditions.

CONCLUSION 14/7 - ACTION FOR THE RESOLUTION OF PROBLEMS CAUSED BY AND TO TRAFFIC JOINING OR CROSSING THE MAJOR TRAFFIC FLOW IN THE NAT REGION

That:

a) the USA accelerate its negotiations with adjacent States South of the USA in order to develop a common view regarding the handling of traffic flows operating between Europe and the Caribbean Region and points beyond;

b) the USA convene, after completion of work in accordance with a) above, a meeting of suitably qualified representatives from Canada, France Portugal, Spain, the United Kingdom, the USA and IATA (and, if required, representatives from States in the CAR Region) to develop proposals for the accommodation of the different traffic flows to the South of the Organized Track System including those joining or crossing the OTS from the South; and

c) upon completion of the task under b) above, a suitably composed working group study the problems caused to traffic joining the OTS from points of origin in the Northern part of Europe, applying to this task the experience and methodology adopted for the work undertaken under b).

Agenda Item 4: Determination of the new format of the NAT Traffic Forecast prepared by the NAT/TFG.

4.1 General

4.1.1 At its 13th Meeting, the Group had devoted some time to measures, which in its opinion, needed to be taken in order to arrive at a more useful presentation of NAT Traffic Forecasts. In doing this, it had, inter alia, requested the NAT/TFG to take the views, as expressed by the Group, into consideration in their work on the subject. In addition, it had also posed a number of questions to that Group, the answers to which were felt necessary by the NAT/SPG before it could make further proposals. At the 13th Meeting, the Group had also requested the UK to prepare a new presentation of actual traffic, as observed during one week in July 1977, because it was, at that time, believed that this could be of considerable interest to planners in the preparation of both short-term and longer range measures to facilitate the flow of air traffic in the NAT Region.

4.1.2 As a consequence of the above, the Group, at this Meeting, had therefore before it:

a) a NAT Traffic Forecast from the NAT/TFG, covering the period from 1977 to 1981 together with a projection to 1986;

b) the replies from the NAT/TFG to five questions which had been addressed to that Group by the NAT/SPG at its 13th Meeting; and

c) an analysis of air traffic in the North Atlantic above FL270 during the week from 15 to 21 July 1977, prepared by the United Kingdom.

4.1.3 When reviewing the material under a) and b) above the Group noted that this had been discussed by the NAT/TFG at a Meeting in September 1977 in the European Office of ICAO, but had, for some unexplained reason, reached the Secretary of the Group only a few days before the opening of this Meeting, i.e. some 6½ months later. As this was not the first time that relations with the NAT/TFG had taken an inordinately long time to conclude, the Group felt that this could possibly call for two consequences:

a) to suggest that the NAT/TFG may wish to review its internal working arrangements with the aim to achieve more rapid processing and presentation of its work to interested parties; and

b) a certain degree of caution on the part of the NAT/SPG in imposing a workload on the NAT/TFG which it may not be able to cope with.

4.1.4 It was believed that the latter aspect was particularly relevant because experience in other Regions had shown that, if the workload resulting from the adoption of complex and time-consuming data collection and forecasting methods was beyond the realistic capacity of those expected to perform these tasks, the results were generally worse than if simpler methods, requiring less work, were adopted. It was therefore agreed that, in making any future proposals on traffic forecasting, this aspect should receive major consideration.

4.1.5 The above contention was further supported by the fact that, since meteorological conditions played a major rôle in the manner in which air traffic was handled, or could be expected to be handled, at a given moment, but could under no conceivable circumstances be introduced into a forecast, any such forecast would only be of restricted use in short-term ATC planning, even though it was useful for air navigation systems planning in the medium and longer term. As a consequence, it was therefore believed inevitable that, regardless of the sophistication of a Region-wide forecast, provider States would still be required to supplement this by more detailed traffic analysis and forecasting processes meeting their specific needs.

4.1.6 With this in mind, the Group reviewed once more its requirement for NAT Traffic Forecasts and the proposals made hereafter were believed to constitute the optimum compromise which could, at this time, be found between the various contradictory aspects described above.

4.1.7 The Secretary informed the Group that, in submitting its material to this Meeting, the Rapporteur of the NAT/TFG had suggested that means be found to obtain the nomination of a Member to that Group by Portugal, because it had been found in the NAT/TFG that collaboration in its work by a suitably qualified Member from that State could significantly facilitate (and at the same time improve) its work. Even though the NAT/SPG was not concerned by this matter, it nevertheless expressed its support of this proposal because of the beneficial consequences this may have on the planning for crossing and joining air traffic in the Southern part of the NAT Region.

4.2 Routes to be covered in the Data Collection on actual traffic and in the NAT Traffic Forecast

4.2.1 The Group noted that, in the reply to one of the questions posed to the NAT/TFG, this latter had stated that, contrary to past practice, they would be prepared to make forecasts on more specific traffic flows in the NAT Region than had been the case so far, provided actual traffic data provided by the OACs to the NAT/TFG was also related to the same flows. In fact, the NAT/TFG had proposed eight specific traffic flows through the NAT Region and, after review and discussion within the Group, the NAT/SPG proposed that the nine traffic flows described hereafter should serve as the basis for the collection of data on actual traffic and for future forecasting activities. The increase by one traffic flow by the NAT/SPG over those proposed by the NAT/TFG resulted from a decision of the Group to split the NAT/TFG proposed traffic flow "Iberian Peninsula to and from North America" into one, covering the traffic flow between the Iberian Peninsula and the USA, and another one between the Iberian Peninsula and Canada.

4.2.2 The traffic flows retained by the Group were therefore:

Route No.	Traffic Flow
1	between SCAN and NAM (East and mid-West)
2	between EUR and NAM on OTS throughout
3	between EUR (excl IBE) and NAM (mid-West)
4	between EUR (excl IBE) and NAM (West)
5	between EUR (excl IBE) and CAR (and beyond to SAM)
6	between IBE and USA
7	between IBE and Canada
8	between IBE and CAR (and beyond to SAM)
9	between NAM and North AFI

EUR = Europe
IBE = Iberian Peninsula
SCAN = Scandinavia
NAM = North America
CAR = Caribbean
AFI = Africa
SAM = South America

4.3 Collection of data on actual traffic

Traffic flows covered

4.3.1 The data collection on actual air traffic should cover that traffic operating along the routes described in para. 4.2.2 above and this in the order listed.

Data collection period

4.3.2 Because of the seasonal variations in air traffic densities in the NAT Region, and also because highest density did not occur on all of the routes covered by the data collection during the general high density summer season, it was agreed that two data collections per year, each of one week's duration, should be made. The two seven-day periods thus required should be:

a) from 0001 GMT on 1 July to 2400 GMT on 7 July; and

b) from 0001 GMT on 1 November to 2400 GMT on 7 November.

4.3.3 Deviations from the above specified periods should only be made if, due to unforeseeable circumstances (industrial action, etc.) the data collection during such a period would not be representative of the weekly traffic cycle within the season during which it was made. In this case, an alternative seven-day period should exceptionally be chosen by common agreement between all parties concerned by the data collection. This postponed collection period should however be kept as close as circumstances permit to the periods described in 4.3.2 above.

Reporting of Traffic Figures

4.3.4 Actual traffic, counted during the two seven-day periods mentioned above, should be related to the following three specific periods:

a) Average Day;

b) Busy Day; and

c) Busy Hour.

4.3.5 Traffic figures for the Average Day will be obtained by adding the total number of movements for each of the two directions of the route to which they refer during the entire data collection period and by dividing the sum thus obtained by seven.

4.3.6 Traffic figures for the Busy Day will be obtained by selecting for each of the routes and for each direction on these routes the highest traffic figure recorded during the seven day data collection. This figure, together with an indication of the day of of the week on which this figure was recorded will constitute the Busy Day figure for the route and direction on that route.

4.3.7 Traffic figures for the Busy Hour will be obtained by selecting for each of the routes and for each direction on these routes the highest traffic figure recorded in one clock hour during the Busy Day. This figure, together with an indication of the hour within which this figure was recorded, will constitute the Busy Hour figure for the route and direction on that route.

4.4 Editing of actual traffic data

4.4.1 The actual traffic data collected by OACs in accordance with the above provisions should be transmitted by the OACs concerned to one designated provider State and that State should collate and edit the data thus received in a consolidated document which should be presented to the NAT/TFG and the NAT/SPG for further action. In editing this material, the State concerned should also provide a "stop-the-clock" presentation for the Busy Hour for each route and each direction so that the respective traffic distribution during that hour would be visualized.

4.4.2 The Group noted that Canada had volunteered to accept the above described task for the two data collections in the year 1978, and that the Canadian Member of the NAT/TFG would take the initiative in proposing the required details for consideration and action by the NAT/TFG.

4.5 Presentation of the Forecast

4.5.1 Based on the material prepared in accordance with 4.4 above, it would then be expected that the NAT/TFG would prepare a traffic forecast covering the next five years, following the year of the actual traffic data collection and also a traffic projection ten years ahead. This traffic forecast and projection should be produced by the NAT/TFG as soon as possible after submission of the actual traffic data and should be presented to ICAO in the usual manner.

4.5.2 The forecasts for the Busy Day and the Busy Hour for each direction on each of the routes covered by the forecast should also include an indication of the types of aircraft used on these routes during these periods and the operationally preferred height-bands for their operation on these routes. It was expected that this information could be obtained from qualified sources within the States having Members appointed to the NAT/TFG.

4.5.3 As to the forecasting method used by the NAT/TFG, the NAT/SPG felt that a comparatively simple forward projection would be satisfactory to meet the intended use to be made of the forecasts. As to the forward projection ten years ahead, the NAT/SPG felt that the method at present employed by the NAT/TFG was satisfactory.

4.6 Conclusion

4.6.1 The Group hoped that provider States concerned, as well as the NAT/TFG would find it possible to respond promptly to the above proposals for re-arrangement of the NAT traffic forecasts and that it would be possible for the NAT/TFG to produce a forecast, corresponding to the above specifications, for the first time in 1979.

CONCLUSION 14/8 - REVISED PROVISIONS FOR THE COLLECTION OF NAT TRAFFIC DATA

That NAT provider States concerned organize, as of 1 July 1978, data collections on actual air traffic in the NAT Region in accordance with the specifications in para. 4.3 of this Summary and that, in 1978, Canada undertake the editing of this data in accordance with the specifications in para. 4.4 of this Summary.

CONCLUSION 14/9 - REVISED NAT TRAFFIC FORECASTS

That the NAT Traffic Forecasting Group take maximum account of relevant provisions in the Summary of this Item in preparing revised NAT traffic forecasts and make all necessary efforts to ensure that the first NAT traffic forecast in the revised format can be presented in 1979.

Agenda Item 5: Conclusion of final arrangements for a large scale data collection in Summer 1978 on longitudinal separation in the NAT Region

5.1 General

5.1.1 When considering the measures required as a prerequisite to a possible reduction of longitudinal separation in the NAT Region at its 13th Meeting, the Group had agreed that these should, inter alia, include:

a) the development of an improved mathematical model for the assessment of the collision risk in relation to longitudinal separation in the NAT Region; and

b) the organization of a data collection of sufficient duration regarding longitudinal separation to ensure that data obtained during this exercise, when assessed in accordance with the improved model mentioned in a) above, would yield results which could be used in reaching an operational decision on this matter.

5.1.2 At this Meeting, the Group was presented with two papers by the UK Member covering the above points and, based on these papers, it agreed to review the subject under the following four main headings:

a) the mathematical model for the assessment of collision risk in relation to longitudinal separation;

b) review of the factors relevant to an operational decision on the longitudinal separation minima to be applied in the NAT Region;

c) organization of a data collection on longitudinal separation; and

d) possible future action in this field in the light of developments at this Meeting.

5.2 Improved mathematical model

5.2.1 The Group reviewed an improved mathematical model regarding the collision risk in relation to longitudinal separation and agreed that this model should serve as a basis for the mathematical-statistical assessment of the data, expected to be obtained by the data collection exercise described hereafter.

CONCLUSION 14/10 - MATHEMATICAL MODEL REGARDING COLLISION RISK IN RELATION TO LONGITUDINAL SEPARATION

That the material contained in Appendix A to the Summary of this Item be used as the mathematical model regarding collision risk in relation to longitudinal separation.

5.3 Factors relevant to an operational decision on longitudinal separation minima in the NAT Region

5.3.1 When considering the mathematical model, the Group had already noted that this, by necessity, was based on the assumptions covering the worst possible cases of loss of longitudinal separation and its resultant consequences. The Group therefore found it once more necessary to confirm, as has already been done in its discussion of Item 1 (para. 1.1.3 refers), that the operational decision to modify the existing longitudinal separation minima in the NAT Region would have to take into account all relevant factors.

5.3.2 In the case of longitudinal separation, the Group agreed that there could already be identified two such factors which had not been included in the mathematical model but which, in the operational decision to modify longitudinal separation, should receive consideration. These were:

a) that, due to the progressive derogation of longitudinal separation, there existed normally the possibility for intervention by ATC in those cases where such derogation assumed significant proportions; and

b) that, when dealing with that part of the traffic operating "above the weather", a visual look out by pilots could alert them to close longitudinal encounters, thus provoking corrective action on their part before a collision occurred.

In the latter case it was also noted that this applied not only during daylight but also at night because of the improved lighting of aircraft.

5.3.3 The Group refrained from attributing any specific weight to these two factors at this time because it felt that this was too early, but it nevertheless agreed to retain these considerations for use in an appropriate manner, on future occasions as and when this became necessary. The same applied to the need to improve methods for the compensation, in longitudinal separation, of differences in Mach numbers between successive aircraft on the same track and levels in different wind conditions. (Item 5 of NAT/SPG Summary/13 refers).

5.3.4 In this context, the Group also noted that its proposal for amendment of the NAT RAC SUPPS regarding adherence to the ATC approved Mach number by pilots was now under active consideration within ICAO. It also took this opportunity to confirm its interest in the earliest possible completion of action by ICAO, with the assistance of States able to do so, on Recommendation 1.3/5 of the LIM NAT RAN Meeting (1976) regarding the development of specifications for Mach number indicators.

5.4 Data collection on the longitudinal spacing between aircraft in the NAT Region

5.4.1 Based on a proposal presented by the Member of the UK, the Group agreed to organize a data collection on the longitudinal spacing between aircraft operating in the Organized Track System in the NAT Region during the summer of 1978 for a duration which would permit the collection of sufficient data so that application of the mathematical model to it will yield statistically conclusive results.

5.4.2 The scope of this data collection and relevant arrangements for it are described in Appendix B to this Item.

CONCLUSION 14/11 - DATA COLLECTION ON THE LONGITUDINAL SPACING BETWEEN AIRCRAFT IN THE NAT REGION

That the material contained in Appendix B to the Summary of this Item be used as the basis for the organization of a data collection on the longitudinal spacing between aircraft in the NAT Region during the summer of 1978.

5.5 Expected future action on this subject

5.5.1 The Group reviewed its future work programme on this subject, as developed at its 13th Meeting, in the light of the developments described above (Item 10 of NAT/SPG Summary/13 refers). It found that the only modification required to this work programme was that, under the fourth subject listed for consideration at the 15th Meeting of the NAT/SPG (para. 10.2.2 of NAT/SPG Summary/13 refers), the UK should, if possible, make available to that Meeting any results it may have on the data collection mentioned in para 5.4 above.

Appendix A
to Item 5

COLLISION RISK AND LONGITUDINAL SEPARATION IN THE NAT REGION

CONTENTS

REFERENCES

1 INTRODUCTION

A theory of collision risk for longitudinal separation standards is presented herewith suited to present and future navigation techniques and based on earlier work presented at NAT/SPG 5 and RGSCP/3 (Refs. 2 & 4). The main difference compared with the earlier work is in the calculation of the longitudinal overlap probability. The collision risk equation is used to indicate the size of sample required to substantiate a reduction in the longitudinal separation standard.

2 DESCRIPTION OF THE CONTROL SYSTEM

The method of calculating collision risk described is applicable to a system in which the longitudinal separation standard is applied to times as reported by aircraft at the entry to each organised track (by re-clearing if necessary after receiving the aircraft reported times) but subsequently reliance is placed on aircraft maintaining filed Mach numbers to avoid total loss of longitudinal separation, although in real life there is occasional intervention as a result of confliction revealed by position reports. There is, therefore, a degree of 'caution' in the system model dependent on the effectiveness of intervention which is not taken into account. Where the second aircraft of a pair is cleared at a higher Mach number the separation applied at the entry point is increased by Air Traffic Control. (Section 4 of Ref. 5 gives a brief discussion of current practice, which will be evaluated more fully during the course of this study).

3 THE COLLISION RISK EQUATION

3.1 Collision risks for the longitudinal case are given by an equation similar to those for the lateral and vertical cases, i.e:

$$N_{ax} = 2\times10^{7}\Pi_{x}P_{y}(0)P_{z}(0)\left[\frac{|\bar{\dot{x}}|}{2\lambda_{x}} + \frac{|\bar{\dot{y}}|}{2\lambda_{y}} + \frac{|\bar{\dot{z}}|}{2\lambda_{z}}\right] \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

3.2 N_{ax} is the expected number of accidents per 10 million flying hours, due to failure of longitudinal separation. Each of the terms on the right-hand side of equation (1) is discussed briefly below.

3.3 Aircraft Dimensions

We take:

λ_x = 0.033 NM (= 200 ft) = the average length of an aircraft

λ_y = 0.033 NM (= 200 ft) = the average wingspan of an aircraft

λ_z = 0.0085 NM (= 50 ft) - the average vertical dimension of an aircraft

These values have been used in all recent NAT/SPG calculations (Ref.3) and are regarded as the best estimates of the operating environment.

3.4 Probability of Lateral Overlap, $P_y(0)$

3.4.1 $P_y(0)$ is the probability of lateral overlap (i.e lateral separation less than a wingspan) for a pair of aircraft assigned to the same track. For the Fifth NAT/SPG Meeting this quantity was calculated from a distribution of track-keeping errors calculated at the Fourth NAT/SPG Meeting as representing the navigation performance over the area. The distribution, calculated as described in sections 1.4.3.1.2 and 1.4.3.1.3 of Reference 1, is a weighted average of distributions observed by different radars. From this distribution the value $P_y(0) = 0.0012$ was calculated and this can be taken to represent the situation pertaining in 1967.

3.4.2 The fact that this value was so small showed that aircraft derived considerable protection from "Longitudinal collisions" because of their poor track-keeping ability in the NAT region. Clearly $P_y(0)$ is larger today because of more accurate navigation, in particular inertial navigation.

3.4.3 To show how $P_y(0)$ depends on navigational accuracy define $f(Y)$ to be the probability density function of lateral deviation from track. In Attachment 1 it is shown that:

$$P_y(0) = 2\lambda_y \int_{-\infty}^{\infty} [f(Y)]^2 dY + \text{terms of order } \lambda_y^3$$

Where λ_y is the average aircraft wingspan. The terms of order λ_y^3 are negligible in comparison with the λy term. $Py(0)$ can thus be calculated from the experimentally observed lateral deviation distribution $f(Y)$.

3.4.4 To estimate $Py(0)$ here we must thus take a specific function for $f(Y)$. We will use a double exponential function $f(Y) = 1/2\lambda_1 . \exp(-|Y|/\lambda_1)$, which represents the 'core' distribution quite adequately, so that:

$$P_y(0) = \frac{\lambda y}{2\lambda_1}$$

The INS lateral 'core' described elsewhere (Ref. 5) has an estimated standard deviation of 3.64 nm at the OCA exit where risk is concentrated. (This estimate may be slightly high because of grouped data.) This gives:

$$P_y(0) = \frac{0.033}{2} \times \frac{\sqrt{2}}{3.64}$$

$$= 0.0064$$

which shows that since 1967 the increase in wingspan and the improvement in navigational performance through INS have increased the lateral overlap probability $Py(0)$ by more than a factor of 5. It should be noted that at the end of the oceanic track, aircraft coming off the ocean will navigate more accurately over a VOR, although this will be both outside

the oceanic control area and usually within the protection of radar cover.

3.5 Probability of Vertical Overlap, $P_Z(0)$

$P_Z(0)$ is the probability of vertical overlap (i.e vertical separation less than aircraft thickness) for a pair of aircraft assigned to the same flight level. The NAT/SPG agreed at its Second Meeting to retain a value of 0.25 for this parameter, and this value is used currently (Ref 3).

3.6 Probability of Longitudinal Overlap, Π_X

Π_X is the probability (i.e the proportion of time) that a typical pair of aircraft assigned to the same track and flight level, are in longitudinal overlap (i.e longitudinal separation less than an aircraft length). Methods of estimating Π_X will be discussed later in this paper.

3.7 Average Relative Across-Track Speed, $|\bar{\dot{y}}|$

$|\bar{\dot{y}}|$ is the average relative across-track speed of two aircraft, assigned to the same track, about to collide. A value of 20 knots is taken, as laid down in 4.4.2.1 of Reference 1. (This value will require careful review).

3.8 Average Relative Vertical Speed, $|\bar{\dot{z}}|$

$|\bar{\dot{z}}|$ is the average relative vertical speed of two aircraft about to collide. It is taken as 1 knot, as specified in Section 4.4.2.1.3 of Reference 1.

3.9 Average Relative Along-Track Speed, $|\bar{\dot{x}}|$

$|\bar{\dot{x}}|$ is the average relative along-track speed of a pair of aircraft which collide due to loss of longitudinal separation. The NAT/SPG agreed (4.4.2.3.1 of Reference 1) that the value of 13 knots used for lateral and vertical collision risk calculations was not appropriate to longitudinal separation since it must be larger if longitudinal separation is to be lost during the period taken to cross the NAT OCA. Methods of estimating $|\bar{\dot{x}}|$ will be discussed later in this paper.

3.10 Collision Risk

$$N_{ax} = 2 \times 10^7 \, \Pi_X \, 0.0064 \times 0.25 \left[\frac{|\bar{\dot{x}}|}{0.066} + \frac{20}{0.066} + \frac{1}{0.017} \right] \quad \ldots\ldots\ldots \quad (2)$$

Thus:

$$N_{ax} = 485000 \, \Pi_X \, (|\bar{\dot{x}}| + 23.9) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

4 PROBABILITY OF LONGITUDINAL OVERLAP

4.1 The problem of estimating the probability of loss of longitudinal separation is different from the corresponding problems for lateral or vertical separation. In the vertical case, for example, if the separation standard were 1,000 feet, any pair of aircraft would be assigned flight levels which differed by zero, or 1,000 feet, or 2,000 feet and so on, and the "vertical collision risk" would be due almost entirely to pairs with a nominal separation of 1,000 feet. The longitudinal case is different because if, for example, the minimum standard were 15 minutes aircraft could be put into the system with nominal separations of 15, 16, 17 or 18 minutes and so on, with significant and different contributions to collision risk from each of those separations. Thus it is necessary to calculate how likely each of these separations is (i.e a set of numbers, or a continuous function) instead of the single number (occupancy or proximity) associated with a single possible separation for the given minimum standard.

4.2 Thus, instead of a single number E_X we have a set of numbers $E_X(m)$ which denote the probabilities that the reported time of a typical aircraft at the beginning of the track differs from that of the next following aircraft (after adjusting for Mach number difference as described in Reference 5) by m minutes, i.e. between $m-\frac{1}{2}$ and $m+\frac{1}{2}$ minutes.

4.3 The distribution of separation loss, after adjusting for Mach number difference, has a probability distribution $P_X(u)$ which is the probability that between $u-\frac{1}{2}$ and $u+\frac{1}{2}$ minutes are lost. (Note the difference in definition compared with the 1968 Fifth NAT/SPG Appendix 4-A. The analysis in this section is the main change between the two treatments.)

From $P_X(u)$ a quantity $Q_X(u)$ can be defined -

$$Q_X(u) = \sum_{v=u}^{v=\infty} P_X(v)$$

so that $Q_X(u)$ is the probability that there has been a separation loss of at least $u-\frac{1}{2}$ minutes. The probability of a separation loss between $u-\frac{1}{2}$ and $u+\frac{1}{2}$ minutes is $Q_X(u) - Q_X(u+1)$. Note that the separation loss refers to that observed at the end of the track, i.e at the boundary of the oceanic control area.

4.4 Thus, the probability that separation has been lost (i.e aircraft arrive in the wrong order - or in overlap longitudinally) is

$$g_X = \sum_m E_X(m)\ Q_X(m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

If separation loss is correlated with initial separation this estimate may be pessimistic so that its use in system design would be over-cautious. This can be equated with the probability of an overlap during a trip *if* repeated overtakings never occur for any given pair of aircraft.

For a multiple overtaking to happen an aircraft would need a sizeable relative velocity during the trip (on average at least 32 kts for the North Atlantic) and then after the overtaking the relative velocity would have to reverse in sign before the end of the oceanic zone.

4.5 In the longitudinal analysis at the Fifth NATSPG a very cautious estimate of Π_X was made. Π_X was estimated by finding the probability that aircraft are in overlap at the end of the oceanic control zone. This gives a very pessimistic estimate of Π_X, as the chance of overlap is negligible along most of the track and only becomes significant near the oceanic exit boundary. Note that one definition of Π_X is the ratio of hours in longitudinal overlap to total hours for a typical aircraft pair.

4.6 With the assumptions of section 4.1 and using the fact that a longitudinal overlap takes a time $2\lambda_X/|\dot{\bar{x}}|$, the expected overlap time of an aircraft pair per trip is:

$$\frac{2\lambda_X}{|\dot{\bar{x}}|} \times \sum_m E_X(m)\ Q_X(m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

A further factor 2 present in the earlier version of this report arose as a result of an incorrect definition of the factor Π_X. Thus, for a trip taking time T to cross the OCA we have:

$$\Pi_X = \frac{2\lambda_X}{|\dot{\bar{x}}|T} \times \sum_m E_X(m)\ Q_X(m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

Taking T = 195 minutes = 3.25 hours gives:

$$\Pi_X = \frac{0.02}{|\dot{\bar{x}}|} \sum_m E_X(m)\ Q_X(m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

4.7 Collision Risk

Substituting eqn (7) into eqn (3) gives (after some rounding):

$$N_{ax} = 10{,}000\ (1 + 23.9/|\dot{\bar{x}}|) \sum_m E_X(m)\ Q_X(m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

This expresses the collision risk in terms of the relative speed $|\dot{\bar{x}}|$ and the convolution of two functions.

(i) E_X the "longitudinal occupancy distribution"

(ii) Q_X the "loss of separation distribution"

Values of E_X, Q_X will be determined for the present system from the proposed data collection.

5 DATA COLLECTION SAMPLE SIZE ESTIMATION

5.1 It has been shown that the collision risk depends on the parameters

$$|\bar{\dot{x}}|,\ E_x(m),\ Q_x(m)$$

The $E_x(m)$ are the simplest to estimate. The OCA entry time of a typical aircraft at the beginning of the track differs from that of the next following aircraft on the same path, after adjusting for Mach number difference as described in Reference 5, by m minutes.

5.2 The average relative longitudinal velocity $|\bar{\dot{x}}|$ for aircraft which have lost longitudinal separation will be difficult to estimate except by considerable extrapolation. For loss of separation, however, an *average* relative velocity of about 32 kts is required over the oceanic zone. It would seem reasonable to suppose that this is representative of the overlap relative velocity.

5.3 Let us therefore take as an *illustration* of likely magnitudes involved (only the leading $E_x(m)$ terms make substantial contributions in the expression (8), simulation studies are necessary for better estimates):

$$|\bar{\dot{x}}| = 32 \text{ kts}, \quad E_x(m) = 0.02, \quad m \geq 15 \qquad (9)$$

The $E_x(m)$ figures are suggested by Table 2 of Ref 5 (see also section 4.5 of Ref. 5). The $|\bar{\dot{x}}|$ is the minimum required for an overtaking during a crossing - equation (8) shows that this gives a cautious estimate for the collision risk. This gives:

$$N_{ax} = 350 \times \sum_m Q_x(m)$$

Thus, for N_{ax} to be less than 0.2, the RGCSP Target Level of Safety (Ref 6) $\sum_m Q_x(m)$ must be less than 1 in 1750. As the terms in this series will very probably rapidly decrease with increasing m we can infer that the probability of losing more than 14.5 minutes must be less than about 1 in 2500.

5.4 For a minimum entry interval of 10 minutes we assume that $E_x(m)$ is again 0.02 for all $m \geq 10$. This implies that the probability of losing 9.5 minutes or more must be less than 1 in 2500.

5.5 The size of sample required to demonstrate that such a level of safety has been achieved in a given area depends on the degree of confidence required. For example, if we wanted a confidence level of 90% a sample of $2500 \times \log_e 10 = 5{,}700$ proximate pairs of aircraft would be sufficient provided none of them lose more than 9.5 minutes of separation. For 80 proximate pairs a day this means a sample over about ten weeks. By assuming a symmetric distribution (gains typical of losses) the required data sample can be halved, indicating a sample over about five weeks.

6 THE 1977 PILOT DATA COLLECTION

6.1 The collection and analysis of a sample of data on aircraft time-keeping performance, for 1 - 3 July 1977, is reported in DORA Comm. 7713 (Ref. 5). Figure 1 uses the data on changes in planned separation presented in Table 1 of Ref. 5. It shows the proportion of pairs (in both directions across the OCA) which gained or lost more than m minutes after correcting for difference in Mach number. The crosses in Figure 1 represent the data set when doubtful cases are removed (for these pairs it is thought that there could have been an error in the time of a position report, because the data appear to show a sudden change in separation between adjacent reporting points and fairly constant separation during the other parts of the crossing).

6.2 Figure 1 is plotted on logarithmic graph paper so fitting a straight line through the points would be equivalent to assuming a double exponential distribution. The line drawn on the figure is a parabola which corresponds to a normal distribution with a standard deviation of 3.02 minutes. The fit is quite good out to about two standard deviations, but the small quantity of data lying further out than this makes the rest of the distribution very unreliable. The effect upon the inferred tail of removing four doubtful cases is considerable.

6.3 Figure 2 shows the estimated distribution of *losses* of separation (again after correcting for cleared Mach number differences) and is calculated by assuming that gains are typical of losses, so the proportion of pairs shown in Figure 1 are simply halved. (See Section 4 of Ref. 5 for a discussion on gains being typical of losses.) Figure 2 is plotted on Normal probability paper so fitting a straight line is equivalent to assuming a Gaussian distribution. The line shown corresponds to a Gaussian with standard deviation 3.02 minutes.

6.4 The importance of Figure 2 is that it shows that if we *assume* a Gaussian form for time discrepancies the present system would probably not be at an acceptable risk level for 10 minutes separation - because the probability of losing more than 9.5 minutes would be greater than 1 in 2500, in fact about 1 in 1500. There is no reason to expect that the tail error frequencies would be more favourable than Gaussian but they might be less so. The main data collection will, therefore, have the primary aim of determining the magnitude of the tails of the time discrepancy distribution.

REFERENCES:

1 Summary of Discussions of the 4th Meeting of The North Atlantic Systems Planning Group (NAT/SPG):Paris, 17 - 28 June 1968

2 Summary of Discussions of the 5th Meeting of The North Atlantic Systems Planning Group: Montreal, 4 - 18 December 1968

3 Limited North Atlantic Regional Air Navigation Meeting (1976): Montreal, August 1976

4 Working Paper 3: First Meeting of Working Group C of ICAO Review of the General Concept of Separation Panel: 9 - 11 March 1971

5 Longitudinal Separation of North Atlantic Traffic, by D.M. Penna, UK CAA/DORA Communication No 7713 (1977)

6 Target Levels of Safety in Controlled Airspace, by P. Brooker and T. Ingham, CAA Paper No 77002 (1977)
The data tables of this report have recently been brought up-to-date in:
Fatal Accident Statistics for Passenger Air Transport Services, 1960 - 1976, by S J Devon, CAA Paper No 77027 (1978).

(Page 5 - A - 10 left blank intentionally)

CALCULATION OF $P_y(0)$

1. $P_y(0)$ is the probability of lateral overlap for a pair of aircraft assigned to the same track. Let $f(Y)$ be the probability density function of lateral deviations from track. If one aircraft is a distance Y off track, then the probability that the two are in lateral overlap is:

$$\int_{Y - \lambda_y}^{Y + \lambda_y} f(v)dv$$

Hence, by summing over all possible Y values (weighted by $f(Y)$):

$$P_y(0) = \int_{-\infty}^{\infty} f(Y) \int_{Y - \lambda_y}^{Y + \lambda_y} f(v)dv \, dY$$

Expanding $f(v)$ as a Taylor series about $v = Y$ gives:

$$P_y(0) = \int_{-\infty}^{\infty} f(Y) \{f(Y).2\lambda_y + f''(Y)\frac{\lambda_y^3}{3} + ..\} dY$$

If we make the reasonable assumption that $f(Y)$ does not vary rapidly in a distance λ_y then all terms except the leading one can be neglected, i.e:

$$P_y(0) = 2\lambda_y \int_{-\infty}^{\infty} [f(Y)]^2 dY$$

2. For a double exponential distribution for $f(Y)$ with parameter λ_1 i.e:

$f(Y) = e^{-|Y|/\lambda_1} \times \frac{1}{2\lambda_1}$ and standard deviation $= \sqrt{2}\lambda_1$ we have:

$$P_y(0) = \frac{\lambda_y}{2\lambda_1}$$

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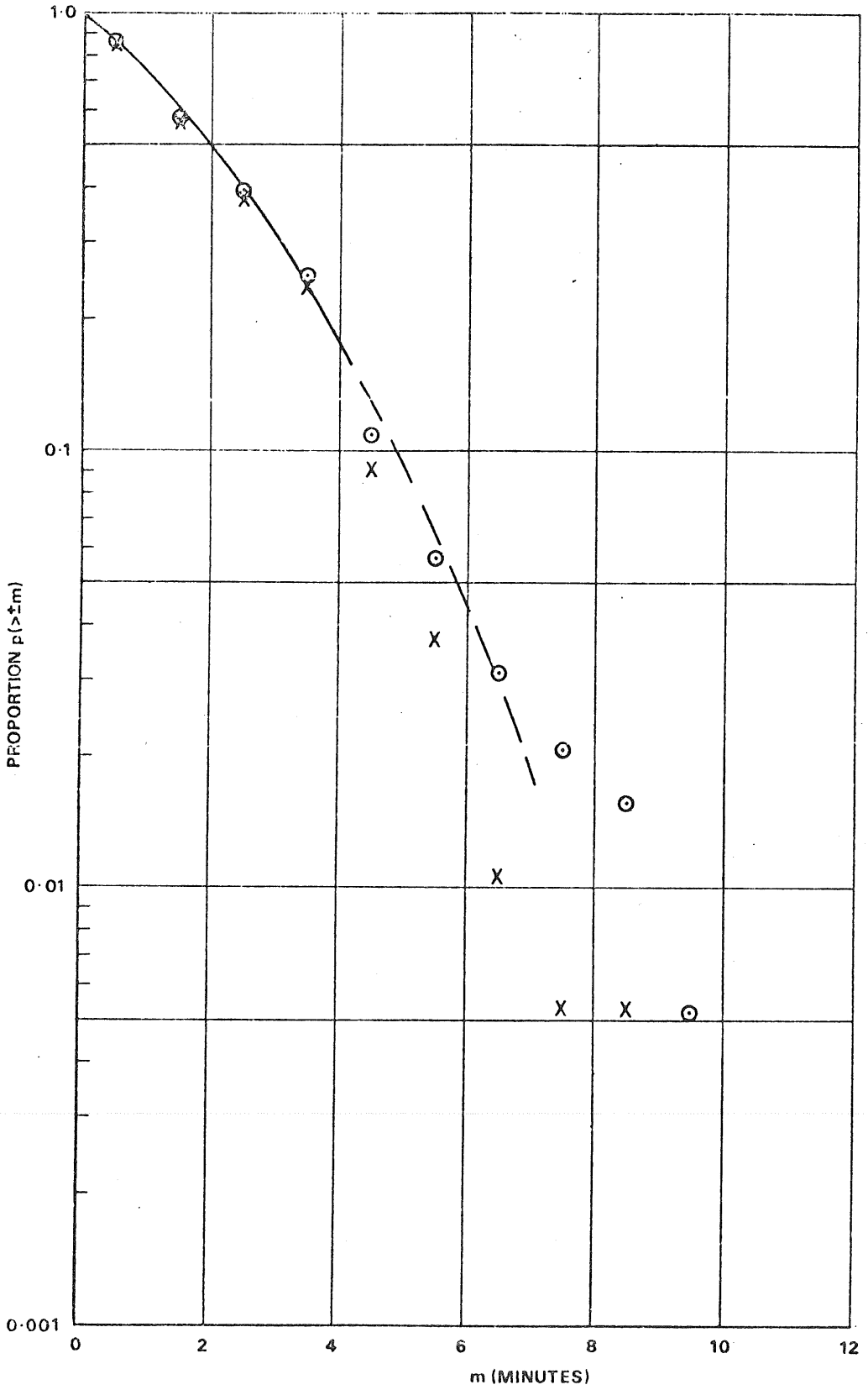
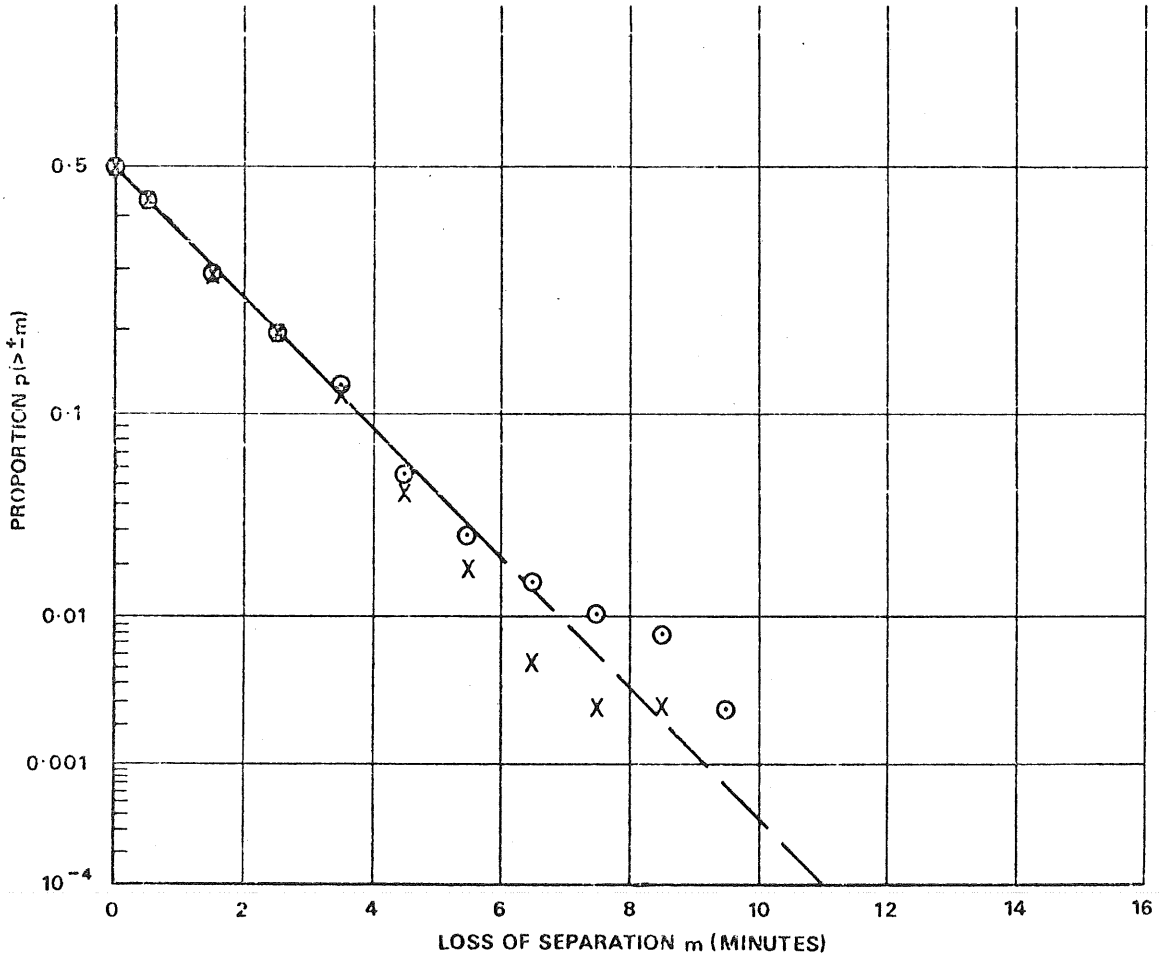
FIGURE 1



ESTIMATED PROPORTION OF PAIRS SHOWING A LOSS OR GAIN OF SEPARATION OF MORE THAN m MINUTES AT END OF OCA, AFTER CORRECTING FOR DIFFERENCES IN CLEARED MACH NUMBER (1977 DATA)

FIGURE 2



ESTIMATED PROPORTION OF PAIRS SHOWING A LOSS OF SEPARATION OF MORE THAN m MINUTES AT END OF OCA, AFTER CORRECTING FOR DIFFERENCES IN CLEARED MACH NUMBER (1977 DATA)

Appendix B
to Item 5

LONGITUDINAL SEPARATION IN THE NORTH ATLANTIC REGION DATA COLLECTION PROGRAMME

1. GENERAL METHOD

1.1 The basic object of the study is to observe the separation of pairs of aircraft, at the same flight level, as they cross a given datum line within 60 minutes of each other, ascertain that they nominally follow the same track and maintain the same flight level, and observe the separation as they cross another datum line.

1.2 If the cleared speeds are not the same, two different methods of determining safe separation are presently in use. Shanwick OAC generally makes an allowance of four minutes for each 0.01M by which the second aircraft is faster than the first. This is added to the minimum separation of 15 minutes, and becomes the minimum acceptable separation between the aircraft at the Eastern OCA boundary for Westbound aircraft. At Gander OAC computer-generated times are printed out on a flight strip and the OCA controller directly assesses whether adequate separation exists at all stages of flight. These computer times are based on the aircraft's flight plan Mach No. and the forecast time of arrival at the OCA entry point, and are compiled using forecast winds and temperatures. For the purposes of the survey, there will exist a requirement to obtain actual wind velocities and temperatures experienced by the aircraft involved. These would be obtained from MET reports currently sent from designated aircraft and passed to the Headquarters of the UK Meteorological Service at Bracknell. In the interest of obtaining accurate assessment of conditions, it may be necessary to nominate more aircraft to send back these reports.

1.3 Information on OCA crossing times will be matched to flight clearance information, and only if all three match up will a flight be considered for subsequent pairs in the separation analysis. It is expected that any deviation from planned separation of greater than five minutes will be analysed separately, and flight strips for any phase of flight affecting the OCA crossing may be requested for further study.

1.4 The study will make it possible to examine cases in which control centres have to intervene to restore minimum longitudinal separation between two successive aircraft. It will also be possible to determine the relative accuracies of the corrections made by OACs for aircraft of differing Mach Nos., and the effect that these have on reduced separations.

1.5 At present pilots are required to inform North Atlantic OACs if their forward estimates are in error by five minutes or more. Any decrease in minimum separation arising from this survey may require that they inform the OACs of any change in forward estimates of three minutes or more. To check the possible changes in workload, pilots will be requested to notify OACs of changes in forward estimates of three minutes or more for the period 21 August 1978 to 10 September 1978.

2. LIMITS OF STUDY

2.1 The study would be confined to aircraft which enter the NAT Region between 45N and 60N at the Canadian OCA boundary at the Fishpoints or over Newfoundland navaids, and exit the OCA at the Shanwick OCA boundary between 49N and 61N, and vice versa. The aircraft involved will be flying between FL 275 and 400, following the tracks specified in the North Atlantic track system for that particular day or night. A map of the area is at Attachment 1 to this Appendix. It is accepted that these limitations reduce the available information. (In an ideal situation all aircraft crossing the MNPS area would be sampled, but there are practical considerations which make this impossible).

2.2 By limiting the study to aircraft flying in the OTS the collection of data is greatly simplified. All such traffic, civil and military, will be recorded, but those aircraft which are recleared to another route or flight level within the OCA will be excluded from the analysis of proximate pairs, because unless the exact timing of the climb or arrival on the new route was known, an accurate flight profile could not be computed, and any separation analysis would be mere conjecture.

3. DURATION OF STUDY

3.1 It has been estimated that information will be required for some 6000 pairs of aircraft. A pilot study indicated that this data would take up to three months to collect. The survey therefore will start on 3 July 1978 and continue until the required number of usable pairs has been obtained, but in any case not later than 29 September 1978. It is intended to have a test run of the system on 7 June 1978 to ensure that the data collection methods are satisfactory.

4. BASIC INFORMATION REQUIRED

4.1 For each flight it is required to know :

a) the flight number;

b) the aircraft's cleared track, Mach No., and flight level;

c) its time at the OCA boundary on entry;

d) its time at the OCA boundary on exit;

e) whether there has been any deviation from clearance (in which case the flight records will not be used for pair comparison).

4.2 Difficulties arise when attempting to obtain accurate times at the OCA boundaries. Because of the lack of radar cover at the Canadian OCA boundary, automatic data collection there is not feasible, whereas at the Eastern OCA boundary radar cover is almost total over the band of latitude under consideration. Sophisticated new radar installations at Prestwick and Shannon will enable automatic recording of aircraft crossing the OCA boundary to take place for almost all ocean entry/exit points. Detail requirements are therefore not the same for both boundaries.

5. EASTBOUND TRAFFIC - GANDER OCA

5.1 Eastbound tracks in the summer months are normally oriented towards the South of the area under survey, and the majority of the traffic enters the OCA soon after crossing the last navaids in the Gander FIR. On those tracks starting to the North of the Gander FIR, aircraft normally enter the OCA across the Fishpoints (Prawn, Porgy, Scrod, Oyster, etc.,) at their OCA cleared flight level and speed. It is therefore considered that these crossing times should provide sufficiently accurate information for the study. However, in marginal cases, the time overhead the previous navaid may be used for verification.

5.2 Because the Fishpoints are the start of the NAT track system in the OCA, Gander ACC receive all reports of aircraft at these points. Hence Gander ACC should collect the information for all the Eastbound flights.

6. WESTBOUND TRAFFIC - GANDER OCA

6.1 In the case of Westbound traffic into the Gander FIR. it is suggested that Gander ACC records the time overhead the first ground-based navaid.

6.2 Westbound traffic crossing through the Fishpoints North of St. Anthony presents a somewhat greater timing problem because of the accuracy required. These aircraft do not necessarily maintain their cleared flight levels and tracks once past the Fishpoints. Thus, only those flights which cross Fishpoints and continue to the first ground-based navaid without a change of flight level or route can be considered for the study. The time over that aid will enable the time at the Fishpoint to be confirmed. Therefore, it is suggested that Moncton ACC records the time of the Fishpoint report and of crossing the navaid concerned, and the flight level of Westbound aircraft.

7. TRAFFIC EASTBOUND AND WESTBOUND CROSSING SHANWICK OCA BOUNDARY

7.1. Automatic collection of data on aircraft crossing the 10W OCA boundary between 55N and 61N is possible using an extension of the new LOCUS 16 system now completing installation at Scottish ACC Prestwick, and which is scheduled to be in use by the start of the study.

7.2 The rest of the OCA boundary, between 55N and 49N can best be monitored by two radar installations in the Irish Republic, the Shannon ATC radar at Woodcock Hill and the EUROCONTROL radar at Mount Gabriel. Automatic collection of the required data should be possible using the radar data processing system.

8. FLIGHT DETAILS

8.1 Relevant flight data, e.g. aircraft identification, ATC clearance, etc., will be obtained manually from an analysis of flight progress strips. This processing will enable some editing of the information to be carried out, for example, the elimination of data on those aircraft on random tracks. For the purposes of obtaining flight information, strip analysis need only take place at Prestwick, although all flight progress strips relating to aircraft crossing the area of the survey will have to be held until the analysis is complete, not only at Shanwick and Gander OACs, but also at Shannon, Scottish Moncton and Gander ACCs.

8.2 The preliminary analysis of flight progress strips to be carried out at Prestwick will show up flights authorized to deviate from their basic oceanic cleareance by Shanwick OAC. This analysis will not highlight those aircraft cleared to deviate by Gander within their OCA. However, information on reclearances within the Gander OCA is passed by Gander OAC to the aircraft by way of Gander Radio, and is confirmed by teletype back to the OAC. These reclearances will also be forwarded to a specific address at NATS Headquarters in London.

9. NOTAM ACTION

9.1 Part of the method of obtaining automatic operation of the data collection will involve the setting of discrete, non-standard SSR codes by aircraft crossing the OCA Eastbound, and the maintenance of domestic codes Westbound, in both cases until the aircraft have passed the OCA boundary. Joint NOTAM action will be taken by Canada, Ireland and the United Kingdom prior to, and during the course of the survey, in order to publicise the survey and to promulgate any temporary changes in procedures.

9.2 NOTAM action will also be taken to announce the temporary introduction of reporting of changes in forward estimates by three minutes or more in the North Atlantic airspace.

9.3 A draft of the proposed NOTAMS is attached at Attachment 2 to this Appendix.

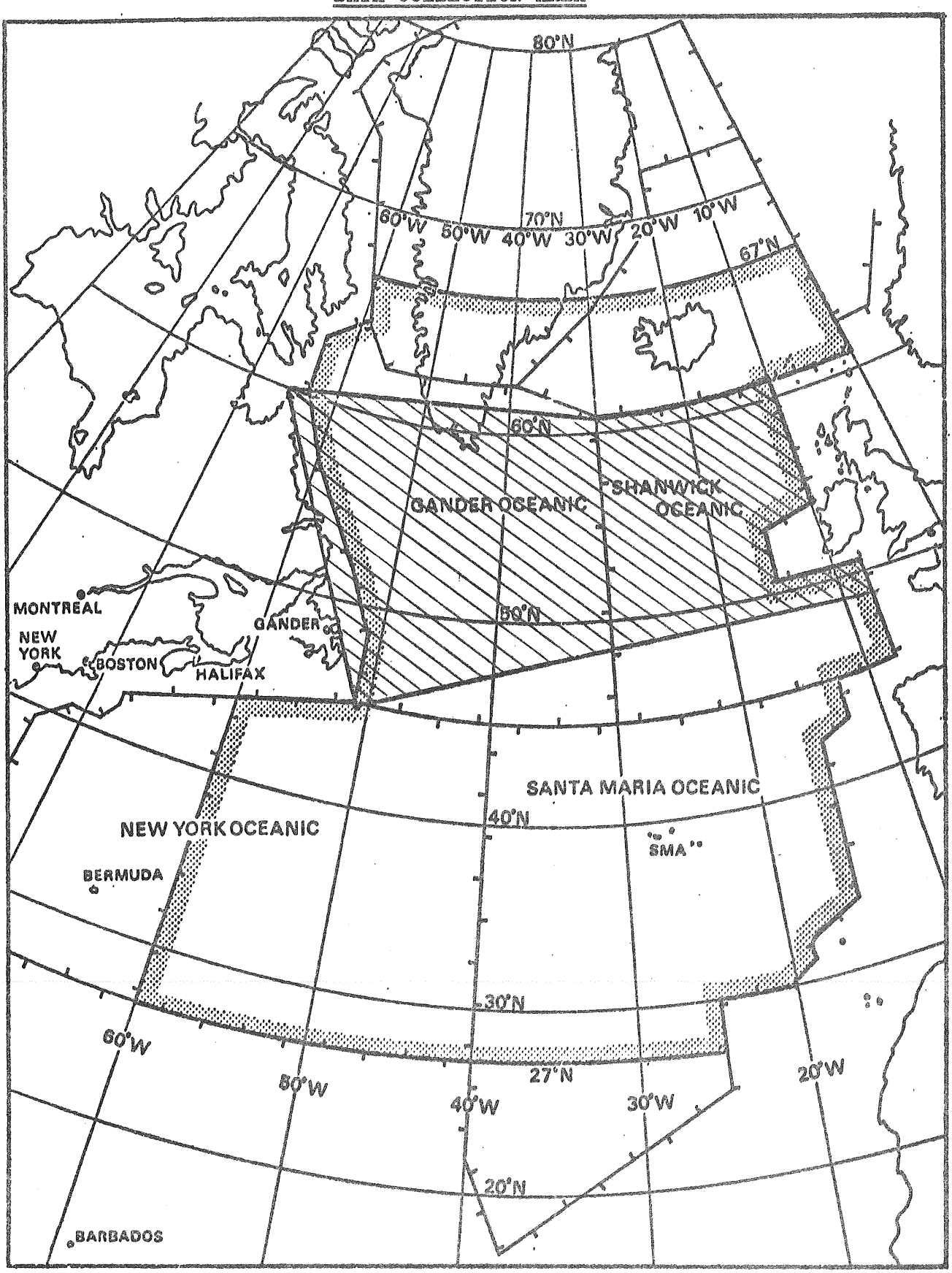
10. SYSTEMS FAILURE

10.1 In the event of a system breakdown at an OAC, either as a result of, say, major technical unserviceabilities or industrial action, there exists a requirement for the other States involved in the data collection to be informed as quickly as possible in order that combined remedial action be taken or that the further collection of data should be suspended.

10.2 Failure of the automatic data collection system at Prestwick or Shannon will not jeopardise the survey, since a manual back-up system will be available on a stand-by basis.

10.3 A list of representatives from States involved is contained in Attachment 3 to this Appendix.

DATA COLLECTION AREA



DRAFT NOTAM NO.1

Longitudinal Separation Data Collection

1. As a result of a proposal approved by the 14th Meeting of the North Atlantic Systems Planning Group arrangements have been made to collect data in order to determine the longitudinal spacing between aircraft in the Organized Track System (OTS). The data collection will take place from 3 July to 29 September 1978 and will involve aircraft flying between FL 275 and 400 inclusive.

2. During this period it will be necessary for aircraft operating in the OTS to comply with new procedures concerning the use of SSR.

2.1 Eastbound aircraft will be assigned discrete codes by ... OAC at some stage in their flight. These should be maintained until after crossing the Eastern boundary of Shanwick OAC or until such time as a new code is assigned to the aircraft by the ATC unit in whose area of responsibility the aircraft operates.

2.2 Westbound aircraft entering the Shanwick OCA North of 48N will be required to maintain the discrete codes assigned to them by European Continental ACCs until 60NM West of the Eastern boundary of Shanwick OCA, and then revert to normal code (A3000).

DRAFT NOTAM NO.2

Temporary Suspension of NAT RAC SUPPs Regarding Revision of Forward Estimates

1. At some future date, consideration may be given to changing the minimum longitudinal separation between aircraft following the same track at the same flight level in the North Atlantic Region, NOTAM ... refers. This could lead to a requirement for pilots to report changes of forward estimates of three minutes or more, rather than the currently prescribed five minutes. (ICAO Regional Supplementary Procedures, Doc 7030/2, Part 1, para. 5.3.2.5 refers).

2. In order to assess the changes in workload, both in the air and on the ground, resulting from this, a trial application will be made during the period 21 August to 10 September 1978. During this period, the relevant provisions of Doc 7030 are therefore temporarily suspended for those aircraft participating in the data collection exercise. Pilots of such aircraft shall therefore report any change of forward estimates of three minutes or more during the above specified period.

Attachment 3
to Appendix B

LONGITUDINAL SEPARATION DATA COLLECTION

LIST OF CONTACTS

The following is a list of personnel who may be contacted directly in the event of any inquiries concerning the above data collection :

UNITED KINGDOM

Mr M.J.A. Asbury
National Air Traffic Services
Room T1110
Space House
43-59 Kingsway
London WC2B 6TE

Tel. 01-379-7311 Ext. 2399

Alternate:

Mr M. Penna
Civil Aviation Authority
Room 820
Space House
43-59 Kingsway
London WC2B 6TE

Tel. 01-379-7311 Ext. 2542

IRELAND

Mr T. O'Connor
Air Traffic Services
Department of Tourism and Transport
Frederick Building
Setana Centre
Frederick Street South
Dublin 2

Tel. Dublin 771207

Alternate:

Mr R. Howley
Director, Air Traffic Services
Department of Tourism and Transport
Frederick Building
Setana Centre
Frederick Street South
Dublin 2

Tel. Dublin 771207

CANADA	Mr E.B. Dohaney Unit Procedures Officer Gander ACC International Airport Gander, Newfoundland
Alternate:	Chief, Gander ACC Gander ACC International Airport Gander, Newfoundland

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Agenda Item 6: Initial discussion of future trends in navigation and ATS in the NAT Region as they present themselves after the introduction of the MNPS and determination of future detailed work required on this subject.

6.1 General

6.1.1 At the 13th Meeting, this Item had been included in the Agenda of the 14th Meeting because, at that time, the Group had felt that it might be useful to take a look at anticipated, more significant changes to the air navigation system, or any parts thereof, and the likely effects these may have on its future operation.

6.1.2 In reviewing this Item at this Meeting, the Group agreed that in doing so, the following five aspects should be taken into consideration:

a) likely changes to the mode of operation of air transport operations in the NAT Region, resulting from changes in policy regarding air transport in general;

b) likely significant changes to aircraft performance of those types of aircraft used in the NAT Region;

c) significant changes to the navigational capability of aircraft engaged in NAT operations;

d) changes to the operation of the air traffic services system in the NAT Region likely to have an influence on air transport operations; and

e) introduction, on a more extended scale, of cost-benefit considerations into the operation of the air navigation system in the NAT Region.

6.1.3. With respect to a) and b) above, the Group felt that, within the next ten years or so, it was most unlikely that significant changes, having a pronounced effect on the air navigation system, were likely to occur. It was, however, understood that it could be expected that traffic in the North Atlantic would continue to increase at moderate rates and that this increase in traffic would have to be catered for by an appropriate increase in the capacity of the air navigation system. It was however felt that the NAT traffic forecasts provided sufficient information in this respect.

6.1.4 As to the navigation capability of aircraft, the Group felt that there again it was unlikely that, within the same time frame, any spectacular changes, affecting the greater part of the traffic operating in the Region, would occur.

6.1.5 With respect to changes in the ATS system, the Group felt that there existed three fields in which significant changes were possible and which if realized, could have a marked influence on the operation of the ATS system. These were:

a) the introduction of electronic data processing facilities into ATC, including the direct computer-to-computer exchange of ATS data;

b) the provision of direct, static-free pilot-controller voice communications throughout the Region(or air-ground data links providing a similar facility); and

c) the provision of a traffic surveillance system to ATC.

6.1.6 Finally, with respect to cost-benefit considerations, the Group appreciated that, because of the general tendency towards the imposition of user-charges, these might acquire more weight in the decision-making processes regarding the future operation of the air navigation system.

6.1.7 As to the more widespread introduction of electronic data processing facilities, the Group noted that, while this should increase the capacity and efficiency of the ATC units concerned, it would however, inevitably, also result in a need for stricter discipline in the composition and transmission of ATS messages and this both in air-ground, as well as in ground-ground communications. (See also para 10.7 of this Summary).

Possible changes to the ATS system

6.1.8 With respect to direct pilot - controller voice communications (and/or air-ground data links) and the provision of a traffic surveillance system to ATC, this was obviously dependent on the provision of a suitably adapted satellite providing coverage throughout the NAT Region. The Group noted that, outside ICAO, a number of primarily technically oriented bodies were engaged in studies on this subject. From documentation produced by these bodies, it also

appeared that, at least in some cases technical solutions were proposed while the search for the operational problem they were intended to solve had only been conducted in a somewhat superficial manner, and this both as regards the operational requirement for a technical solution as well as its application within a realistic time frame.

6.1.9 It was therefore believed useful if Members of the Group, in consultation with their home administrations, would investigate possibilities how closer co-operation could be established between the Group and representative bodies engaged in satellite studies to ensure a mutual exchange of information on operational and technical developments affecting work in the field of satellites, so that a realistic assessment of the operational needs could be provided to the technical bodies involved and the operational side could be kept current of existing and expected technical possibilities.

CONCLUSION 14/12 - CO-ORDINATION IN THE FIELD OF SATELLITE TECHNIQUES

That Members of the Group:

a) investigate, with their home administrations, improved possibilities for the exchange of information between those concerned with operational air navigation problems in the NAT Region and those engaged in studies on the technical possibilities offered by satellites as cost-effective methods of resolving such problems; and

b) present their proposals in this respect prior to the 15th Meeting of the NAT/SPG.

Cost-benefit considerations

6.1.10 While it was agreed that, for the reason given in para. 6.1.6 above, cost-benefit considerations would gain in importance in regional planning, it was nevertheless believed that practical solutions to this aspect of regional planning would take some time to be developed because of the complexity of the subject.

6.1.11 The Group noted however that, at least with respect to one specific aspect of ATS planning, initial work on its cost-benefit aspects had already been undertaken by the UK and this referred to the future decision whether, in the field of separation, reduction of longitudinal separation in the MNPS airspace should be given preference to the introduction of composite separation or vice versa, once it had been firmly established that both measures could be applied without risk to the safety of operations.

6.1.12 The UK Member presented a paper on this cost-benefit problem which suggested the use of a simulation model for this purpose based on that which had been developed by the 6th Meeting of the NAT/SPG for a review of traffic on the NAT Organized Track System, on the understanding that this model would be updated to take account of the current traffic structure. The model should use data from the collection exercise on the longitudinal spacing between aircraft, mentioned in Item 5, and supporting information obtained from operators and ATC on the desired and cleared tracks and flight levels for flights between different points of origin and destination.

6.1.13 The Group was informed that Shanwick OAC had already suggested the need for particular care in the analysis of the model insofar as assumptions regarding the validity of particular, computer-derived minimum energy tracks and levels were concerned. This aspect would therefore need careful consideration. It also appeared desirable that the data should be spread over the widest possible tinge period since the information obtained could also be used to enhance the accuracy of the occupancy assumption used in the collision risk model. In fact, if possible, the traffic variations throughout a year should be taken into account. Present planning for the simulation model envisages however the use of data of one day per week and this over a period of ten to twelve weeks.

6.1.14 A brief description of the work done so far by the UK and its further intentions on this subject is contained in Appendix A to this Item.

CONCLUSION 14/13 - COST-BENEFIT STUDIES BY THE UK ON SEPARATION IN THE NAT REGION.

That the United Kingdom continue its work on cost-benefit studies relating to separation applied in the NAT Region so that this can be used by the Group, as appropriate, once the Group is confronted with decisions on this subject.

6.1.15 In this context, the Group noted that, at its 13th Meeting, it had included an item relative to this subject on the agenda of its 15th Meeting, it therefore felt that it would be useful if the UK Member could provide appropriate documentation on this subject prior to that Meeting.

6.2 Developments in the field of MET data collection from aircraft

6.2.1 The US Member provided the Group with information on trials conducted in the USA in which aircraft were used to provide and update MET information for a given area based on actual MET conditions encountered. A brief description of this system is contained in Appendix B to this Item.

6.2.2 The Group felt that this system deserved careful observation because, if introduced on a larger scale and in practical operations, it might permit:

a) reduction in the specialised MET services now required to tbe provided in the NAT Region with a resultant saving in costs; and

b) a more frequent and reliable updating of the MET information on which flight planning and the determination of the Organized Track System are based.

6.3 Preparation of NAT/SPG Meetings

6.3.1 While on the subject of future developments, the Group also felt it advisable to consider a more administrative aspect of this subject which was, however, felt to be of sufficient importance to merit recording. This concerned the presentation of new subjects to the Group, both as regards the form and the timing of their submission.

6.3.2 Experience had shown that, in order to reach conclusive results on specific subjects with which the Group was confronted, it was absolutely essential that these be presented to the Group in a concise, comprehensive and well-justified manner and in written form. Furthermore, experience had also shown that, if such proposals were made only at the opening of the Meeting of the Group, it was frequently not possible for participants in the Meeting to state a reasonably authoritative view on the subject because no opportunity had been provided to discuss the matter with all interested parties in home administrations or in the consultative bodies of International

Organizations concerned. This was particularly true for subjects requiring inter-disciplinary co-ordination between operations and technical specialists, such as, the use of technically complex co-operative systems (e.g. SSR) or systems where the modification of the operational parameters could have a significant effect on its technical functioning or vice versa (e.g. electronic data processing facilities, etc.)

6.3.3 The Group therefore agreed that, in future, efforts should be made to produce documentation as complete and as early as possible prior to Meetings of the Group, so that distribution of such documentation could be made well in advance of the departure of participants from their home States to the venue of the NAT/SPG Meeting concerned.

PROPOSALS FOR A RELATIVE COST-BENEFIT STUDY OF POSSIBLE CHANGES TO SEPARATION STANDARDS APPLIED IN THE NAT REGION

1. Introduction

1.1 In the report of the 13th Meeting of the Group, it was envisaged that the future work programme of the Group would include the determination of priorities in the reduction of separation standards in the NAT system, in particular whether the introduction of composites would be more cost-effective than a given reduction in longitudinal separation (para. 10.2.2). A model, basically that developed in the UK and presented to the 6th Meeting, has been updated to conform to current traffic conditions.

2. The Cost Penalties

2.1 Aircraft using the Organized Track Structure on the North Atlantic may be allocated to a track and a flight level other than their choice because of congestion. Even the best choice of a track in the system will in general differ from an operator's estimated "minimum energy" track between his particular origin and destination, because the track system on a given day is drawn up as a compromise between the requirements of various operators. These deviations from the optimum lead to increases in fuel burnt and, sometimes, in flight time, which can be converted into monetary terms. The situation is alleviated by the fact that operators' first choices differ among themselves according to their particular origins and destinations and types of aircraft.

2.2 The cost penalty will decrease with a reduction of separation standards in any dimension. With a reduction in longitudinal separation, more aircraft can be allocated to their first choice of flight path (combination of track and flight level). With a reduction in lateral separation, or the introduction of composites, those aircraft being deviated to a different track have the size of their deviations reduced and even for those aircraft not deviated, the best track of the system may conform more closely to their particular "minimum energy" path. These cost penalties consist of fuel and time penalties which are evaluated in the computer model.

3. The Computer Model

3.1 The core of the model is a simulation of the process of allocating tracks and flight levels in NAT airspace. The model is given a series of aircraft entry times and desired flight paths (track and flight level). These may be either fed in as separate data or as a statistical distribution of flow rates and flight path requirements; in the latter case, the series of aircraft are generated by repeated random sampling. The computer programme considers each aircraft in succession and attempts to fit in to its own preferred flight path. If this flight path is occupied, that is, if some previous aircraft entered it at less than some minimum separation ahead of the entry time of the current aircraft, the programme examines other flight paths until a successful fit is obtained. The "pattern of search" among flight paths remains the same for all aircraft in a single simulation, though it may be varied from run to run. A typical search pattern for a non-composite system is given in Table 1 below:

TABLE 1 - Typical Search Pattern for NAT Flight Path Allocation

Option	Flight Path
1	Preferred Track and Flight Level
2	Next Lower Flight Level
3	Next Upper Flight Level
4	Next Track North (Preferred FL)
5	Next Track South (Preferred FL)
6	2 Flight Levels below Preferred FL
	etc.

3.2 The model can treat eastbound and westbound flows separately; the only effect of each flow on the other is to block out certain tracks and flight levels in the system for the opposing flow. A similar effect may be caused by the action of traffic joining or crossing the mainstream. The computer model can easily be adapted to cope with the effects of peripheral traffic.

3.3. The minimum separation value used as a criterion whether a flight path is occupied may, in the programme, be sampled from a distribution; its relation to the regulation longitudinal separation standard is discussed in paragraph 4.

3.4 The output of the programme will consist of histograms of the distribution of aircraft among tracks and of successful options among aircraft. These two distributions, particularly the latter, will form the input to a separate exercise.

4. Model Validation

4.1 The model will be validated using information from the 1978 data collection. Perhaps 10 days data will be enough, but the 10 days should not be consecutive but should be spread throughout three months to obtain a wide sample of weather conditions and corresponding track patterns.

4.2 Fundamental to the track allocation process is the minimum longitudinal separation allowed at entry below which controllers divert aircraft to another flight path. A previous study for NAT/SPG has shown that it was not necessarily equal to the statutory longitudinal separation, but appeared to have a mean value somewhat greater than the statutory value. In the present case it is intended to derive the level of minimum separation by adjusting it in the model until the resulting track allocation pattern agrees as closely as possible with actual practice. Another assumption which can be adjusted in the process of "fine-tuning" the model is the search pattern among flight paths (Table 1).

4.3 The first stage of the model validation process will be performed using actual data on individual flights. A second stage will then take place using the same data input in the form of statistical distributions. The output from this simulation would not be expected to give quite so good a comparison with reality as the previous stage; however, the statistical method of input is essential when hypothetical variants of the system come to be considered.

5. Cost Study

5.1 Following the validation process, the next step will be to attach cost penalties to the pattern of deviations found in the first place for the existing system. This will involve examining the track systems in use on the 10 days of the exercise and comparing the air mileage on the tracks with the operator's desired tracks. All these distances should include the effects of domestic routings. It is hoped to obtain assistance here from the operators, some of whom may have computer programmes which regularly estimate these distances. The estimation of the fuel and time penalties is then straightforward, as is the corresponding estimation of the penalties for vertical deviation from aircraft performance data.

5.2 The study will then be repeated using the same traffic data but assuming reduced separation standards. For the study of the 30NM composite system, it will be necessary to draw up a hypothetical track system for the wind patterns on the days in question. This will be done with the assistance of experienced controllers. For the study of reduced longitudinal separation, it will be necessary to reduce the value of minimum entry separation in conformity to the change in the regulatory separation standard. These two studies will give total system cost penalties to compare with the existing system and each other.

5.3 Finally, the studies may be repeated with increased levels of traffic as the NAT/SPG shall require.

6. Peripheral Traffic

6.1 The economic effect of diversions to peripheral traffic was discussed in papers presented to the 7th NAT/SPG Meeting. Although the reduced separation standards, the effect of which is being studied, may not apply direct to the peripheral traffic, they may still have a beneficial effect on this traffic. This is because any reduction in separation standards for the mainstream aircraft will tend to reduce the cross-sectional area occupied by the core of heavily-loaded central flight paths. Thus, additional lightly-loaded flight paths may be available to peripheral aircraft, with a consequent saving in their penalty. The consequent cost saving should be small compared with the saving to the mainstream aircraft but it may well be significant. To investigate it, data on the track occupancies from the simulations of mainstream traffic will be used. This will indicate what flight levels and tracks are likely to be available to peripheral traffic. This information will enable estimates to be made of the deviations suffered by this traffic and its consequent penalty.

7. Data Requirements

7.1 Table 2 shows, in summary form, the data requirements for the study described above and also indicates the sources from which it is expected the data will be obtained.

TABLE 2 - DATA REQUIREMENTS FOR NAT COST STUDY

Data	Source
(a) Data Requirements on Individual Aircraft	
Origin and Destination	Flight progress strips
Oceanic Entry Time	Longitudinal Separation Data Collection
Aircraft Type	
Mach Number	
Track and Flight level Allocated	
Track (preferably LTT) Requested	Oceanic Control Centres
Flight Level Requested	Oceanic Control Centres
Peripheral Traffic - Numbers on Each Axis	Oceanic Control Centres
(b) Data Requirements on Whole System (for each particular day)	
Actual Track System for that day	Oceanic Control Centres
Hypothetical Track System with 30NM lateral separation	DORA + experienced controllers
Wind Charts for each day	Met Office
Differences between distances on actual tracks and ideal least-time tracks	DORA + Operators
Fuel and time penalties for non-optimum levels	Aircraft Operating Manuals

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Appendix B
to Item 6

DESCRIPTION OF AN AIRCRAFT TO SATELLITE DATA RELAY SYSTEM (ASDAR)

1. Brief description of ASDAR

The development of ASDAR has been jointly funded by the US National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) and is intended in part to make better use of aircraft as meteorological data collection platforms. In the present ASDAR configuration, ASDAR reports are formulated eight times hourly, that is, at intervals of about 125 KM along the flight path. Each report contains values of altitude, temperature, time (GMT), wind speed, direction and aircraft position. The wind and position information is obtained from the onboard inertial navigation systems and the altitude and temperature are obtained from the aircraft air data system. Once per hour, eight reports are transmitted via UHF radio for relay by a geostationary meteorological satellite to a ground station. From the ground station, the data is forwarded to a processing center from which, within a few minutes, bulletins of AIREP-formatted data are sent world-wide to users. Operation of the system as planned will result in the availability of near-real time meteorological information for flight planning purposes. A prototype system has been test-deployed aboard a Pan American Boeing 747 in an FAA approved installation since February 1977, and deployment is now being expanded to a test fleet of 20 aircraft in 1978, a number of which will be operating in the North Atlantic area.

2. Expected future system development

Sufficient aircraft equipped with ASDAR will be operating in the North Atlantic so that a significant amount of ASDAR meteorological data will become available. This development will provide an opportunity to ascertain the type and amount of improvements which may become available through the use of ASDAR, and to determine how to take advantage of these improvements in operations of interest to the NAT/SPG.

Agenda Item 7: Review of the situation regarding the navigation and communication capability of IGA flights in the NAT Region.

7.1 At its 13th Meeting, the Group had dealt in considerable detail with the question of IGA light aircraft flights across the North Atlantic. As a result of its deliberations, the Group had,at that time, come to the conclusion that the only reasonable course of action to obtain improvements in the situation was, to request States of Registry to exercise closer control over these flights, especially as regards their compliance with applicable requirements regarding their communication and navigation capabilities. In addition, it had been agreed that, in co-operation with IAOPA, selected provider States should develop information and guidance material for the use by IGA pilots planning to engage in flights across the North Atlantic by light aircraft, to permit them to better assess the relevant requirements and make better flight preparations. (Conclusion 13/13 refers).

7.2 At this Meeting, the Group noted that the Meeting called for in Conclusion 13/13 had not yet been convened, but it was noted that discussions with interested parties had continued at different levels within a number of States. As a result of these discussions, the US Member presented to the Group a paper containing suggestions, made by interested pilot groups, which were aimed at the alleviation or elimination of some of the requirements with which these flights were at present obliged to comply.

7.3 A detailed review of these proposals including the relaxation of the communication requirements in Annex 2 and SAR alerting requirements for such flights in Annex 11, would required a change to the provisions in these Annexes.

7.4 In view of the fact that those not complying with the relevant requirements constituted a very small minority when compared with those pilots of IGA light aircraft complying with the existing regulations, the Group felt that there was no valid reason to develop any revisions to the existing provisions.

7.5 It was therefore re-confirmed that the only feasible way to obtain necessary improvements in this matter in the NAT Region was to adopt the measures proposed by the Group at its 13th Meeting.

7.6 As to the Meeting called for in Conclusion 13/13, the Group noted that the USA was still prepared to convene such a meeting. The US Member proposed however to postpone this to the latter part of 1978 in order to permit conclusion of certain studies now under way on this subject in the USA, and this was accepted by the Group.

Agenda Item 8: Review of the separation applied between SST aircraft while in supersonic flight.

8.1 Introduction

8.1.1 When considering position reporting procedures in the NAT Region for SST aircraft at its 13th Meeting, the Group had agreed to inscribe in its work-programme the question of lateral separation between SST aircraft while in supersonic flight and to review the matter at this Meeting. In doing so, the Group had expected that the two operators directly concerned by this question would, through IATA, provide this Meeting with appropriate supporting documentation permitting the Group to make a realistic assessment of experience gained in practical operations with SST aircraft so that it could come to valid conclusions.

8.1.2 Unfortunately, at the opening of this Meeting, it was found that no such data was available and, in the brief ensuing discussion, it was not possible to determine with any degree of reliability, what the present situation was, even though opinions were advanced that, up to this time, no significant deviation from track by an SST aircraft had as yet been observed by radar during those portions of the SST flights which were conducted within radar coverage.

8.1.3 In view of this situation and because the representative of IFALPA recalled the position of his Organization regarding any reduction in separation, i.e. that this should only be done provided sufficient statistical evidence, including that derived from actual operating experience, had been analyzed properly, demonstrating that such a reduction would still meet agreed safety requirements, the Group agreed not to pursue this subject any further at this time.

8.1.4 The Group left it however to the operators concerned to provide the Group, at the appropriate time and through appropriate channels, with data permitting it to make an adequate assessment of the question and reach a conclusion. In addition, it requested provider States, having the capability of observing SST aircraft by radar, to keep a check on observed deviations from track, so that this could be made available to the Group when needed.

8.1.5 Finally, the Group agreed that, in any case, the question of the use of reduced lateral separation between SST aircraft should be restricted to those aircraft operating on organized tracks in the NAT Region.

CONCLUSION 14/14 - REDUCED LATERAL SEPARATION BETWEEN SST AIRCRAFT IN SUPERSONIC FLIGHT

That:

a) operators concerned with SST operations provide the NAT/SPG, on their own initiative and through proper channels, with adequate data permitting the Group to make an assessment of the navigation accuracy maintained by these aircraft while in supersonic flight, prior to formulating any views on the advisability of proposing to reduce the present lateral separation minima prescribed between such aircraft while in supersonic flight;

b) provider States being able to observe SST aircraft on radar, keep a check on the track-keeping accuracy of these aircraft, so that this data can be provided to the NAT/SPG when needed.

Agenda Item 9: Review of the HF air-ground communications situation.

9.1 Consideration of the results of the 1977 annual HF data collection

9.1.1 The Group reviewed the analysis, presented by the United Kingdom, of the data collected in the course of the 1977 exercise. The arrangements for the data collection had been the same as for the 1975 exercise, i.e. data relating to three days when the alignment of the organized track system was Northabout, Central and Southabout respectively. It was, however, noted that the actual movements on the day selected for a Southabout track structure were in fact aligned along a split track structure with major traffic loadings on Southerly tracks.

9.1.2 The HF traffic figures were compared with those of the June 1975 exercise, which had been carried out in similar conditions, i.e. a three-day exercise during the peak air traffic season. The comparison showed that there was no significant growth of traffic in the NAT Region.

9.1.3 The loading on the four HF families was, in general, similar to that of 1975. Once again, Family C carried the heaviest load whilst the load on the other three families was broadly comparable. As in previous years the night load fell on the 2 and 5 MHz frequency orders, the day load on the 5 and 8 MHz orders. It was observed that very little use was made of the 13 MHz order frequencies and it was the Group's opinion that frequencies in the 11 MHz order might be more suitable.

9.1.4 Shannon Aeradio once again had the highest peak hour load (71 reports). As expected, HF participation by Søndrestrom was minimal, the majority of reports being on GP VHF. As compared with earlier years a slight improvement was noticed concerning message delays*, being 3.57 minutes in the mean (against 4.08 minutes in 1975). Abnormally high delays (5.32 minutes in the mean) were recorded for Santa Maria, resulting from the inclusion of eleven delays in excess of 20 minutes and two delays exceeding 1 hour.

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*The delay time is the delay from the time at which an aircraft passes over a reporting point to the time the HF ground station has completed reception of the corresponding position report. It therefore includes the delay due to the HF system and the cockpit delay. In this context it should be noted that delays in the transmission of reports from the HF ground station to the responsible control position in the ATC unit concerned are generally negligible (i.e. about 1 minute).

9.1.5 A check on the mode of operation carried out on a total of 1081 flights gave an SSB/DSB ratio of 79 to 21, which represented a significant increase over the 1975 estimates. It was, however, pointed out that the above SSB/DSB ratio was by no means representative of the airborne equipment capability to operate on SSB, which was higher than indicated by the above figure, at least as far as aircraft of the major carriers were concerned. Following from an agreement reached at the NAT/SPG 13 Meeting it was confirmed that, in connexion with the transfer to SSB operation on Families A and D, the above SSB/DSB proportion should be the subject of a double check, in winter and summer respectively, in co-ordination between Shannon and Gander. The first check had already been made in January 1978, and second was due to be made in July 1978.

9.1.6 It was hoped to have full A3H/A3J capability implemented at Shannon by the end of 1978. In this connexion, it was regretted by IATA that at least receive capability could not be provided at an earlier date. (ICAO Doc 9182, LIM NAT (1976), para. 4.1.8 and NAT/SPG Summary/13 para. 9.15 refer).

9.1.7 The Group also confirmed its previous conclusion that, for the time being, there was no need to amend the arrangements (NAT COM SUPPS) for the assignment of traffic to the four HF NAT families, since apart from the slightly heavier loading on Family C, the overall pattern was one of even distribution, with no evidence of overloading. For the same reason, the Group agreed that the introduction of a fifth family would not be required in the immediate future. However, it was believed necessary to keep the HF situation under continued close review and it was agreed that this item should, for the foreseeable future, continue to be included on a routine basis in the Agenda of NAT/SPG Meetings. The Group accordingly agreed that a further exercise would be necessary based on 1978 data - States would need to retain message data relating to all July and August 1978 flights until the collection dates had been agreed. Arrangements would also have to be made prior to the next exercise to ensure that the results would give a sufficiently broad picture of track loadings along the different track alignments and, to the extent possible, reasons for delays of 15 minutes or more. Ireland offered once again to co-ordinate the exercise, whilst the United Kingdom undertook to collate and analyse the results. It was agreed that data from Søndre Strømfjord HF station should be included, for that station continued to form part of the overall NAT HF communication system. Finally, it was, as on past occasions, agreed that, in selecting the dates for the exercise, care should be taken to avoid, if possible, dates affected by industrial action.

Future Requirements for NAT HF Families

9.1.8 The Group was aware that an input on future HF requirements was intended to be provided by some delegations to the ICAO Meeting preparatory to the ITU 1979 WARC. For this reason and because of the non-availability of sufficient data concerning the above requirements, it was agreed not to discuss this point further.

Operation of SELCAL and SELCAL Watch

9.1.9 The instances reported to the NAT/SPG 13 Meeting relating to the non-maintenance of continuous watch on SELCAL by some flights had diminished considerably in the interim. The Group therefore agreed not to pursue this point further, at least for the time being. Aeronautical stations should nevertheless continue to monitor the situation.

CONCLUSION 14/15 ACTION ON NAT HF AIR-GROUND COMMUNICATION MATTERS

That:

a) a three-day data collection exercise be conducted in 1978 with the same arrangements as agreed for 1975, noting that:

1) Ireland will co-ordinate the exercise and select the dates;

2) the United Kingdom will collate and analyse the results;

3) States concerned should retain message data for July and August 1978 until the dates have been selected;

4) Søndrestrom data should be included; and

5) completed data forms should be addressed to:

Civil Aviation Authority (CG2)
Room T1113
Space House
43-59 Kingsway
London WC2B 6TE

b) Shannon and Gander, in co-ordination, make as accurate a check as possible of the NAT/SSB airborne capability by a second check in July 1978;

c) Ireland establish a firm date for the full implementation of A3H/A3J capability at Shannon on Family D and subsequently propose a co-ordinated change to the NAT COM SUPPS as appropriate;

d) aeronautical stations continue to monitor SELCAL operations.

Agenda Item 10: Any other business.

10.1 Introduction

10.1.1 Under this Item the Group dealt with the following subjects:

a) status of proposal for amendment of the NAT SUPPS regarding the need to contact ocean station vessels;

b) situation regarding uniform procedures for the establishment of temporary airspace reservations;

c) use of composite separation by Canada;

d) preparation of a consolidated VHF GP coverage chart for the NAT Region;

e) exchange of view on ATS data exchange requirements in the NAT Region and resultant demands on the aeronautical fixed service in the medium and long term;

f) automated exchange of ATS messages between OACs;

g) updating of the NAT Guidance Material; and

h) arrangements for the next Meeting.

10.2 NAT RAC SUPPs regarding the need to contact Ocean Station Vessels

10.2.1 At the 13th Meeting of the Group it had been agreed that the provision in the NAT RAC SUPPS regarding the need to contact Ocean Station Vessels should be deleted because it had been superseded by events. It had also been agreed that the Member from the Netherlands would ensure that his Adminstration would take necessary formal action with ICAO (Conclusion 13/15 refers).

10.2.2 The Group was now informed by the Secretary that formal action on this proposal for amendment has been concluded on 7 April 1978 and that the consequent change to the NAT RAC SUPPS would be included in Amendment 146 to Doc 7030.

10.3 Situation regarding uniform procedures for the establishment of temporary airspace reservations

10.3.1 The Group noted that, pursuant to NAT/SPG Conclusion 13/12 the European Office of ICAO had raised the subject of temporary airspace reservations with those States which, at one time or another, had resorted to the establishment of temporary airspace reservations in the NAT Region in order to cater for certain national aviation requirements or to conduct such other activities likely to have an effect on flight operations in the NAT Region.

10.3.2 Twelve States had been requested to provide information regarding internal arrangements and to confirm that these met with a number of specific requirements which had been developed by the NAT/SPG at its 13th Meeting.

10.3.3 At the opening of the 14th Meeting, the Secretary informed the Group that replies had been received from the following eight States:

Canada	Portugal
France	Spain
Iceland	United Kingdom
Norway	United States

No reply had as yet been received from:

Cuba	Italy
Denmark	USSR

10.3.4 Extracts from the replies received were made available to the Group and these showed that there was general agreement with the proposals developed by the NAT/SPG at its 13th Meeting. In addition, the USA, in their reply, had indicated that they were engaged in the development of a procedure for the establishment of lateral buffers between the edge of the occupied area and the closest permissible track past that area. Furthermore, the representative of Denmark informed the Group that a reply to the request from ICAO was in preparation in his Administration and that it was most likely that it would confirm acceptance by Denmark of the proposals of the NAT/SPG.

10.3.5 While expressing its satisfaction about the replies received, the Group felt obliged to express its concern over the lack of a reply, primarily from Cuba and the USSR because activities, especially of the latter State, were continuing to pose problems to those States providing air traffic control services in the NAT Region. It was therefore hoped that these States would find it possible to give an early and positive reply to the request addressed to them by ICAO so that the uniform procedures developed by the NAT/SPG could be applied as early as possible by all provider States.

10.3.6 With regard to the procedure under development in the USA mentioned in para. 10.3.4 above, the Group stated its interest in this work and hoped that it could be made available to the Group at an early time so that it could be taken into account in further work on this subject.

CONCLUSION 14/16 - UNIFORM PROCEDURES FOR THE ESTABLISHMENT OF TEMPORARY AIRSPACE RESERVATIONS

That:

a) States, not yet having done so, reply as early as possible to the request of the European Office of ICAO regarding their provisions for the establishment of temporary airspace reservations in the NAT Region and, in doing so, take due account of the appropriate proposals of the NAT/SPG;

b) the United States provide to ICAO the results of their studies on the determination of lateral buffers between the boundary of airspace reservations and the closest track adjacent to it, so that these can be taken into account by the NAT/SPG in further work on this subject; and

c) uniform procedures covering the subject of temporary airspace reservations be developed at the earliest moment after the information requested under a) and b) above has become available.

10.4 Use of composite separation by Canada

10.4.1 At the 13th Meeting, the Canadian Member had informed the Group that Canada intended to extend the use of composite separation along tracks over Labrador and implement this on 1 December 1977. At the time, it had been proposed that Canada clear this matter in direct contact with ICAO in order to remain within the existing ICAO provisions (Item 4 of NAT/SPG Summary/13 refers).

10.4.2 The Canadian Member now informed the Group that composite separation on tracks over Labrador have in fact been implemented by Canada on a trial basis and that experience has shown that this is entirely feasible and has not caused any difficulties. He also pointed out that with the anticipated application of 60NM lateral separation as of 5 October 1978, it was very likely that the trial period would come to a normal end and that therefore no further need existed to sanction the permanent application of this type of separation by Canada through a change of the existing ICAO provisions.

10.4.3 As to the prolongation of 60NM lateral separation on tracks outside the MNPS airspace and in areas which come under the responsibility of the Canadian domestic air traffic services, the Canadian Member informed the Group that measures would be taken to ensure that such separation would only be applied to aircraft meeting the MNPS and that this would be covered in appropriate aeronautical information publications issued by Canada.

10.5 Consolidated VHF GP coverage chart for the NAT Region

10.5.1 At its 13th Meeting the Group had agreed that, in the context of provisions facilitating the conduct of IGA operations in the NAT Region it would be useful to supplement the existing VHF GP coverage chart showing the coverage at 30,000 feet, by one showing the coverage at 15,000 feet. It had also been agreed that, to produce such a chart, States concerned should provide the European Office of ICAO with appropriate coverage diagrams of their VHF facility.

10.5.2 Unfortunately, at the opening of the Meeting only Canada and Denmark had provided the requisite coverage diagrams while those from Iceland, Norway, Portugal and the USA were still outstanding. In the course of the Meeting the charts from Iceland, Norway and Portugal were however provided, while the US Member informed the Group that the chart from his Adminstration would be forthcoming shortly.

10.5.3 Upon review of the situation, it became apparent that, while not normally obliged to do so because VHF coverage from their facilities did not extend into the NAT Region proper, it would however be useful to include facilities in Ireland, Spain and the United Kingdom because they covered the areas immediately adjacent to the NAT Region but still over the High Seas.

CONCLUSION 14/17 - CONSOLIDATED VHF GP COVERAGE CHART AT 15,000 FEET

That Ireland, Spain, the United Kingdom and the USA provide the European Office of ICAO with coverage charts regarding VHF facilities extending into the North Atlantic up to 15.000 feet so that the production of a consolidated chart and its inclusion in appropriate AIPs by NAT border States can be completed.

10.6 Exchange of views on ATS data exchange requirements in the NAT Region and resultant demands on the Aeronautical Fixed Service in the medium and long term

10.6.1 General

10.6.1.1 The Group noted that ICAO planned to hold a limited EUR/NAM/NAT Communications Regional Air Navigation Meeting in the latter part of 1978 in order to reach agreement on the concept for the medium and longer term planning of the Aeronautical Fixed Service in these Regions. The three Regions had been grouped together because it was believed that the aeronautical fixed service in any of these Regions could not be developed in isolation due to their close inter-relation. This applied particularly to the NAT Region which was interspersed between two Regions provided with particularly dense aeronautical fixed services.

10.6.1.2 It was also noted that the agreements concluded for the SCOT-ICE and the ICE-CAN cables were due to expire in 1982 and it was therefore necessary to provide for timely follow-up arrangements.

10.6.1.3 In view of this situation, the Air Navigation Commission had requested the NAT/SPG to provide a contribution to the above-mentioned ICAO Meeting, in the form of supporting documentation to its Agenda Item 1, to the extent that this was found practicable. The Agenda Item referred to above reads:

"Determination of the types of traffic(including message and speech traffic) to be carried in the future on the EUR/NAM/NAT AFTN and/or AFS."

10.6.1.4 Because of the short time between the receipt of the request of the ANC by the Group and the convening of this Meeting, it had obviously not been possible to effect full, inter-disciplinary co-ordination within the home administrations of the Members and it was for this reason that discussion of this subject was restricted to an exchange of views, on the understanding that the views expressed by the Group at this Meeting would not commit their respective home administrations at the forthcoming ICAO Meeting.

Types of communications required

10.6.1.5 The Group agreed that, even in the longer term, there would always exist a basic requirement for three types of communications regarding ATS in the Region. These were:

a) printed communications as now handled on the AFTN;

b) data exchange between ATS computers in adjacent ATC units, and this most likely on a much more increased scale than was now the case; and

c) direct voice communications between controllers in adjacent ATC units in order to resolve control problems of a non-routine nature and possibly affecting flight safety.

10.6.1.6 It was also noted that, while the links serving communications mentioned under a) and b) above were of a fairly stable nature, the communication links required to cater for the needs expressed in c) above were much more dependent on the organization of the airspace and the air traffic services in a given area and therefore susceptible to more frequent adjustments.

10.6.1.7 In the same context, it was also agreed that, in order to assess the loading of communications links and, thus, their possible need of duplication etc., statistical methods now used by postal administrations could be used as far as the links under a) and b) above were concerned. As to the communication links serving the needs in c), the requirement was for immediate and direct access.

Grouping of different types of communication requirements onto a common carrier system

10.6.1.8 From the above it appeared that it would be prudent to provide for two communication carrier systems which would operate independently of each other, one of them covering the communication requirements stated in para. 10.6.1.5 a) and b) above, and the other, the requirements stated in para. 10.6.1.5 c), on condition that both carrier systems meet the comparatively high requirements for reliability and integrity of message content needed for ATS purposes.

10.6.1.9 It was also pointed out that ATS communication requirements would, under no circumstances, permit the simultaneous loss of communication on both carrier systems for any length of time.

Direct connexions between any two communication terminals

10.6.1.10 As far as printed and computer-to-computer communication links were concerned, it was believed that, in the light of modern communication techniques likely to be employed in the implementation of a new, improved communication carrier system, there was little need to formulate any specific requirements.

10.6.1.11 With respect to speech communication links it was however believed that planning of the relevant communications carrier system for the NAT Region should take into account the following three operational requirements:

a) the system should provide for immediate and direct speech communication between adjacent OACs in the NAT Region and between any of those OACs and adjacent continental ACCs feeding air traffic into the area of the OAC concerned;

b) the system should provide for conference type communications between all OACs concerned with the control of air traffic in the NAT Region; and

c) the system should permit through-switching of speech communications to the next centre after the immediately adjacent OAC or ACC with a speech quality such that human intervention at the intermediate station to make communications intelligible should not be necessary. At the same time, this through-switching arrangement should be provided with an over-ride priority access capability at the ATC unit through which the through-switching is effected.

Expected message or speech loading

10.6.1.12 As to printed communications and/or computer-to-computer communications, it was expected that the message loading on the communication carrier links would remain fairly stable. This was due to the fact that, while the introduction of repetitive flight plans, or the establishment of data banks at ACCs for repetitive flight operations may **reduce** the requirement for the transmission of flight plans to the extent as is now the case, this can be expected to be off-set by the increase of messages required for air traffic management purposes and the overall increase in air traffic in the years to come.

10.6.1.13 As to the loading of speech links, there again, the introduction of direct data transfer between ATC computers will relieve the present amount of speech traffic handled. However, since, these links are subject to safety of human life considerations, speech loading alone cannot be accepted as the only criteria for the only criteria for the determination of the operational need for direct links.

Arrangements during the transition period

10.6.1.14 As it was expected that the transition from the present AFS arrangements in the NAT Region to the new provisions would, most probably, extend over a number of years and be effected in a progressive manner, the Group felt it necessary to insist that existing, proven arrangements be only replaced by new arrangements, once the new arrangements had been demonstrated to meet the stringent requirements for continued reliability and integrity in day-to-day operations.

10.6.2 ATS direct speech communications between Reykjavik OAC and Stavanger ACC

10.6.2.1 Further to previous discussions in the NAT/SPG of the longstanding question of the ATS direct speech communications between Reykjavik OAC and Stavanger ACC, the UK Member informed the Group that two possible solutions to provide such a possibility by through-switching at Prestwick had now been suggested by his Administration. The Group expressed its appreciation to the UK Member for the efforts made but as it was felt that the choice of the ultimate solution, both from the operational and financial point of view, depended essentially on Iceland, Norway and the UK, and, in case one of the proposed solutions was chosen, also on Canada, the Group decided to leave this matter to direct negotiations between the administrations concerned, in the hope that these would find an early satisfactory solution to this question.

10.7 Automated exchange of ATS messages between OACs

10.7.1 At the LIM NAT RAN Meeting (1976) it had been noted that, with the increased use of electronic data processing (EDP) facilities by OACs, it might be necessary to develop new and/or revised ATS messages capable of being used for direct insertion into computers and also for automatic exchange between computers of adjacent OACs. Because of the time scale involved regarding the introduction of such EDP facilities at certain OACs in the NAT Region, it had also been recognised that, prior to a satisfactory solution of these problems by the ADAPT Panel of ICAO on a world-wide basis, it might be necessary to develop intermediary procedures to cover the intervening period between the start of operation of the EDP facilities and the application of the world-wide provisions. It was for this reason that Recommendation 2/2 of the LIM NAT RAN Meeting (1976) was formulated.

10.7.2 The Air Navigation Commission, when approving this Recommendation, requested the Secretary General of ICAO to:

"a) consult States concerned with a view to obtaining information on studies undertaken and to take such studies into consideration in work that may be undertaken in follow-up of Recommendation 5/2 of the 9th AN Conference (subsequently entrusted to the ADAPT Panel);

b) invite the NAT/SPG to undertake any necessary co-ordination work in this field and keep ICAO informed of progress made".

10.7.3 At its 13th Meeting, the NAT/SPG therefore agreed that Canada, Ireland, the UK and the USA should continue work in this field implementing mutually agreed message formats on a trial basis when operationally required (during 1978/79) until such time that these had either been included in world-wide provisions or were superseded by them. At the same time, the Group included, as a basis for further work on this subject, a paper presented by the UK Member containing proposals for such messages. (para. 11.4 of NAT/SPG Summary/13 refers).

10.7.4 At this Meeting, the Group was now presented with two papers on this subject, one from the UK Member proposing the institution of operational trials with new ATS messages throughout the larger part of the NAT Region as of 1 January 1979, and a paper from the US Member describing a method of operation different from the proposals presented by the UK Member.

10.7.5 In the course of discussions it was found that, apparently, co-ordination of the various activities in this field had not worked as satisfactorily as was required by the subject. It was also found that the intentions of the Group, as expressed at the 13th Meeting, to limit such co-ordination to only four provider States in the NAT Region, were also not satisfactory because this did not permit a sufficient input from all interested parties.

10.7.6 As it was also recognized that, in view of installation programmes for new EDP facilities both in Shanwick and Gander OACs by about 1981, it was absolutely essential to start some form of trial application of the new provisions as early as possible in 1979 to acquire sufficient experience and allow adequate time for the correction of detected deficiencies before these EDP facilities were brought into operation. Since the proposals of the UK had, however, only been made available to the Group at the opening of the Meeting, it was found that inter-disciplinary co-ordination action, required by all provider States to apply the UK proposals, was not possible during this Meeting (See also para. 6.3 of this Summary).

10.7.7 In view of this somewhat inextricable situation, the Group agreed that the only solution left was, to convene, as early as possible, a meeting of appropriately qualified representatives from all interested parties and to establish a firm timetable for the development and application of the trials required in accordance with the above considerations. At the same time the Group felt that the proposals of the UK should, by means of this Summary, be brought to the attention of all States and International Organizations having interests in the NAT Region, so as to permit them to provide any comments, through the European Office of ICAO, to the above Meeting prior to its convening.

10.7.8 The trial sequence, eventually agreed by the Group was therefore that:

a) States and International Organizations concerned be invited to provide their comments to the European Office of ICAO, not later than 15 September 1978, and that this material be forwarded to the UK Member of the Group by ICAO;

b) the United Kingdom convene, as soon as feasible after 15 September 1978, a meeting of suitably qualified representatives from Canada, Iceland, Ireland, Portugal, the UK and the USA, with participation by IATA and IFALPA, in order to determine the details of the trial application of new or revised ATS messages in the NAT Region, using as a basis for its work the material contained in Appendix A to this Item, and also any material provided to the UK Member of the NAT/SPG by the European Office of ICAO in accordance with a) above; and

c) the final decision on the scope and procedures for the trial application be made, by common agreement amongst all provider States directly concerned, not later than 15 December 1978, and that the subsequent NOTAM required to permit the application of the trials be published by provider States concerned on the AIRAC date of 25 January 1979 with a date of start of the trials of 0001GMT on 22 March 1979.

CONCLUSION 14/18 - TRIAL APPLICATION OF NEW OR REVISED ATS MESSAGES IN THE NAT REGION

That States and International Organizations concerned comply strictly with the provisions set out in para 10.7.8 of this Summary in order to permit the trial application of new or revised ATS messages in the NAT Region, as determined by common agreement amongst the provider States concerned.

10.8 Updating of the NAT Guidance Material

10.8.1 In view of the fact that developments since the last edition of the "Guidance and Information Material concerning Air Navigation in the NAT Region", as issued by the European Office of ICAO, required an update of that document, the Secretary took the opportunity of this Meeting to obtain the views of the Group on:

a) the usefulness of continuing to produce this Guidance Material; and

b) the need to continue inclusion, into an updated edition, of some of the material currently contained in the First Edition of this document.

10.8.2 With respect to a) above, the Group confirmed the continued usefulness of this material and therefore suggested that its publication, in an up-to-date form, be continued by the European Office of ICAO.

10.8.3 With respect to b), the Group proposed that some of the material now contained in the First Edition of the Guidance Material should be replaced by relevant new material developed at this Meeting and as indicated in this Summary. In addition, the Group felt that due to the actual implementation of the MNPS the material on the "Analytical Development of a Minimum Navigation Performance Specification" had lost some of its actuality and was therefore no longer required to be included in the Guidance Material. The same applied to the description of the OMEGA navigation system which was now covered in an ICAO Circular (CIRCULAR 139 - AN/95 refers).

10.8.4 It was however noted that IATA was in the process of developing material concerning cross-checking of navigation information derived from self-contained navigation systesm and it agreed that this was of particular interest in view of its assistance in the early detection of gross errors in navigation caused by insertion mistakes. It therefore requested IATA to make this material available to ICAO as early as possible so that it could be included, if at all possible, in the next Edition of the NAT Guidance Material.

CONCLUSION 14/19 - NAT GUIDANCE MATERIAL

That the "Guidance and Information Material concerning Air Navigation in the NAT Region" be continued to be issued and kept current by the European Office of ICAO.

10.9 Arrangements for the next Meeting

10.9.1 The Group agreed that its 15th Meeting should be held as envisaged in the work programme developed by the 13th Meeting, i.e. some time in Spring 1979, and that it should essentially cover the subjects listed in that work programme, taking into account the amendments made to Item 4 in the light of discussions on Items 5 and 10.7 as recorded in this Summary. (para. 10.2.2 on page 10-3 of NAT/SPG Summary/13 refers).

Appendix A
to Item 10

TENTATIVE PROPOSALS REGARDING TRIALS IN THE NAT REGION WITH NEW ATS MESSAGE TYPES

1. General

1.1 It is proposed to introduce, on an operational trial basis, in the NAT Region, four new ATS message types. The new message types are:

a) Request Clearance (RCL)
b) Position Report (POS)
c) Revised Estimate (RPE)
d) Miscellaneous (MIS)

The AIREP will, however, be retained in its present form except that all times are to be expressed in hours and minutes. A detailed description of the new message types is given in para.3.

1.2 Ground communicators are not permitted to alter the content or sequence of data received in air/ground messages. In order to enable the communicators to process messages in the shortest possible time, it is imperative that pilots observe the following rules:

a) use the correct type of message applicable to the data transmitted;

b) state the message type on the initial call to the ground station, or at the start of the message; and

c) adhere strictly to the sequence of information for the type of message.

2 Start of Trials and Area of Application

2.1 Operational trials using the new ATS message types will commence at 0001GMT on 22 March 1979. The procedures detailed for the transmission of air-ground messages will apply to aircraft operating

(to be determined)

2.2 The details required in In-flight requests for Oceanic clearance from westbound aircraft operating within the United Kingdom UIR/FIR are specified in page RAC 8-5 of AIP United Kingdom. It will greatly assist the communicators operating the clearance delivery channels at Shanwick if these requests are also transmitted in the format and data content specified in para.3 during the trial period.

2.3 Aircraft not affected by these trials shall continue to transmit air-ground data in accordance with currently prescribed procedures.

3. Description of new ATS Message Types

3.1 For the purpose of the operational trials, aircraft shall transmit air-ground messages using standard RTF phraseology, in accordance with the following :

3.1.1 Request Clearance (RCL) - To be used to obtain a clearance or reclearance.

CONTENT OF RCL MESSAGE AND SEQUENCE OF DATA

a) Type of message

b) Flight identification

c) Present position

d) Time over present position (hours and minutes)

e) Present flight level

f) Next position on cleared route

g) Estimate for next position (hours and minutes)

h) Requested Mach number (if applicable)

i) Requested flight level (if applicable)

j) Requested re-route after position shown in (f) (if applicable)

k) Further information or clarifying remarks

NOTE 1: The message implies that when a reclearance is requested in respect of any single item in h), i) or j), or any combination of these items, it is to take effect from the "NEXT" position given in (f). If, for instance, the flight is requesting both a flight level change and a re-route but wishes the level change immediately, this point must be clarified in (k). It is essential that clarifying remarks are restricted to (k) only.

NOTE 2: When a re-route is requested all the points (up to and including landfall) which follow the "next position" given in f) must be given in j).

(examples to be provided)

3.1.2 Position (POS) - To be used when company or MET information is not included.

CONTENTS OF POS MESSAGE AND SEQUENCE OF DATA

a) Type of message

b) Flight identification

c) Present position

d) Time over present position (hours and minutes)

e) Present flight level

f) Next position on cleared route

g) Estimate for next position (hours and minutes)

h) Any further information

(examples to be provided)

3.1.3 Revised Estimate (RPE) - To be used to update estimate for next position.

CONTENTS OF RPE MESSAGE AND SEQUENCE OF DATA

a) Type of message

b) Flight identification

c) Next position on cleared route

d) Revised estimate for next position (hours and minutes)

e) Flight level

f) Any further information

(examples to be provided)

3.1.4 Miscellaneous (MIS) - To be used to convey plain language information which does not conform with an established message format.

(examples to be provided)

LIST OF NAMES AND ADDRESSES OF THE MEMBERS OF THE NORTH ATLANTIC SYSTEMS PLANNING GROUP/

LISTE DES NOMS ET ADRESSES DES MEMBRES DU GROUPE DE PLANIFICATION COORDONNEE ATLANTIQUE NORD/

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